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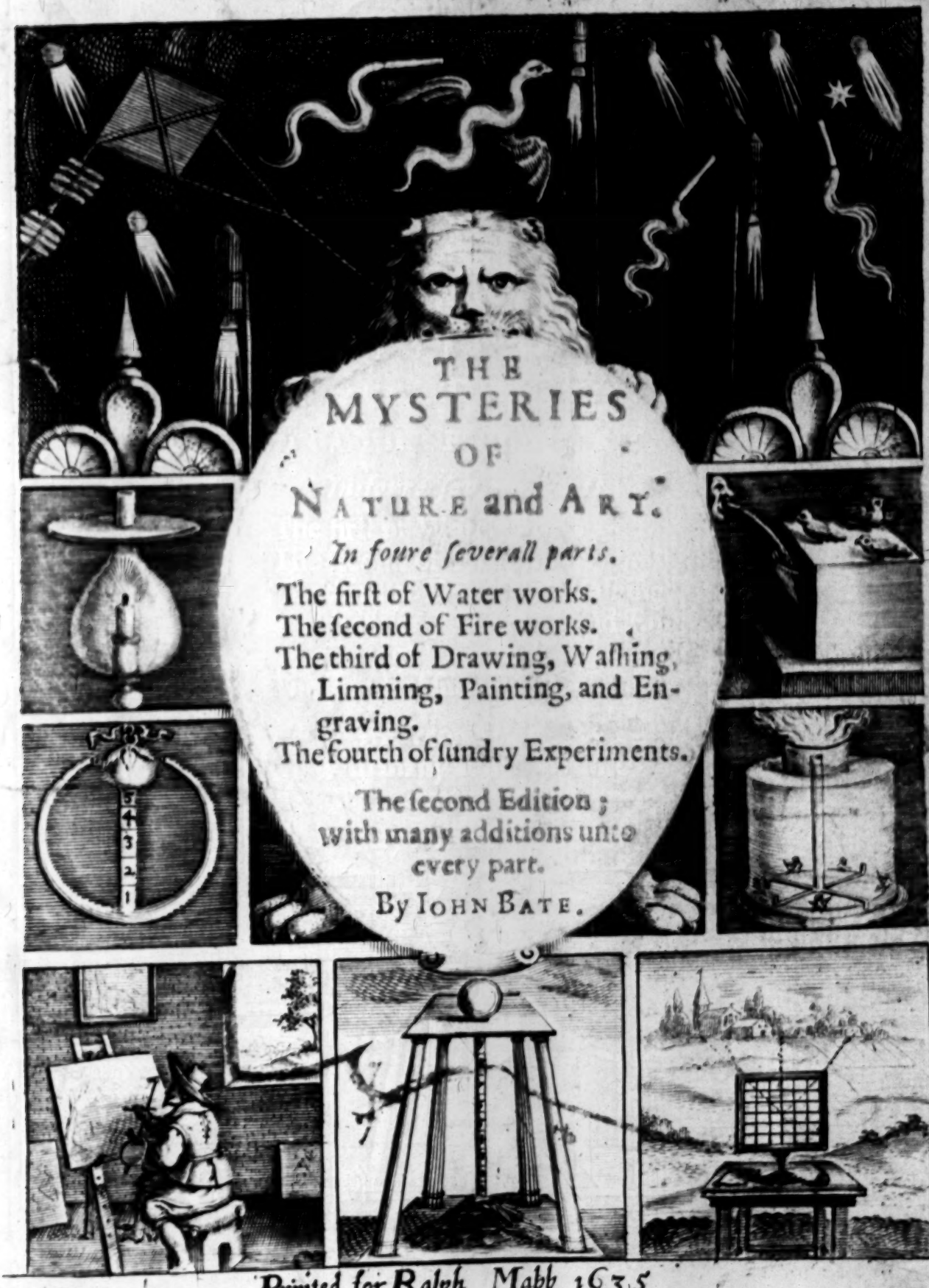


THE MYSTERIES OF NATURE and ART.

In foure ſeverall parts.

The firſt of Water works.
The ſecond of Fire works.
The third of Drawing, Waſhing, Limming, Painting, and Engraving.
The fourth of ſundry Experiments.

The ſecond Edition; with many additions unto every part.

By IOHN BATE.

Printed for Ralph Mabb 1635

The Right Honble
John Earl of BUTE, &c.

95.174

TO
The ingenious Author, *J. B.*

KInde friend, thy worth and fame I muſt admire,
In whom both Art and Nature ſo conſpire
An happy Progenie. And ſith the time is come,
A ſecond burthen delivered by thy wombe;
To ſolemnize the birth, and to expreſſe
My joy, my love, and eke my thankfulneſſe,
I'le be it witneſſe; 'tis no baſe borne brat,
Or father'd onely, not legitimate:
Thy unknowne painefull travaile ſhewes 'twas thine
By birth, thy care from faults it to refine.
'Twas naturall, 'tis youthfull all may ſee,
'Tis active, and ingenious, like to thee.
Free-borne, though forc'd to ſerve a prentiſhip
Of ſeav'n y ears toyle, in which thy wrong did nip
Its taller growth, and mar'd it's fairer feature,
Blaſting the buds of thy rathe-ripe Nature.
But, time 'll befriend thee, and ſpur on a ſpace
To doe thy vertues right, and publique grace:
And thrice welcome to all may that day be,
Which ſhall thee bleſſe with joy of being free.
Though ſure ſuch skill in ſecrets myſticall,
Proclaime thee not to be illiberall.
Thy worke doth ſpeake it ſelfe, and needs no prayſe
Of hired Poetry in ſome begging phraiſe

To catch thy Readers. No, thy well-pen'd ſtile
Of things, not words, doe better grace this pile.
Peace then my prating Muſe, forbeare to ſpread
Riddles not underſtood till they be read.
And rather pray heaven bleſſe them with ſucceſſe,
Theſe Elements may ſafely paſſe the Preſſe;
And being come abroad, as welcome be
Againe to all the world, as now to me.
And ſo (deare Friend) I wiſh thy booke may ſell,
All may have it, that all may ſo farewell.

Thine unfainedly affectionate,

IOS. BERNARD.

To his friend *J. B.* upon his Treatiſe of Art and Nature.

O That *Apelles* lived now! then he
Might draw thee to the life, but alas we
Muſt not attempt that, which the Painters art
Can onely doe: but what, the Painters art
Said I? that can't; no colours but thine owne
Can thee expreſſe, nor yet can Art be ſhowne
In any but thy ſelfe: for thou art thee
Whom Nature joyn'd with Art, doth dignifie.
Therefore when I through ev'ry leafe deſcry
Thy Engines, and in each his property,
I can't deny but that there's both in one:
There's Art, there's Nature, whom thou knew'ſt alone
To joyne; or elſe in Art hath any beene,
Or Natures Treatiſe better then thee ſeene?
Whom thine owne booke here ſhowes, and in which you
Lay open to each cenſure, and each view,
Yea to each curious eye. But what of that?
Wee'll thee (in ſpite of them) perpetuate,
And carpe at carpers, and yet ſtill comprize
Thy vertues in our annuall memoryes.

T. T.

OF VVATER-VVORKS.

IT hath beene an old saying amongst Philosophers, and experience doth prove it to bee true, *Non datur vacuum*, that is to say, Nature will not admit of any vacuity or emptinesse. For some or other of the Elements, but especially Ayre, and VVater doe insert themselves into all manner of concavities, or hollownesses, in, or upon the earth, whether they are such as are formed either by Art or

Nature. For the one it is ſo obvious, and manifeſt, as that it needs not any proofe at all. As for the other, I ſhall make it manifeſt unto you by eaſie demonſtration. Let there be gotten a large veſſell of glaſſe, or other, having beſides the mouth another hole (though but a little one) at the top: poure water into the veſſell by a tunnell thruſt into the mouth of it, and you ſhall finde that as the water runneth into the veſſell, a winde will come forth of the little hole, ſufficient to blow out a candle being held over it. This proveth, that before the water was poured into the veſſell (though to our ſight it appeared to be empty) it was full of ayre, which forced out of the veſſell as the water ran in; and the reaſon hereof is, becauſe the water is by nature of a maſſie, ſubtill, ſubſtance; and the ayre of a windy,

windy, light, evaporative nature: the knowledge of this, with the rarifaction of incloſed ayre, is the ground and foun-dation of divers excellent experiments not unworthy the knowledge of any in-genious Artiſt whatſoever.

windy, light, evaporative nature: the knowledge of this, with the ventilation of inclosed ayre, is the ground and foundation of divers excellent experiments not unworthy the knowledge of any ingenious Artist whatsoever.

Of Water-workes.

To draw water by a Crane.

TAke any veſſell, of what bigneſſe you pleaſe, fill it with water, then take a Crane (that is a crooked hollow Cane) one end whereof, let be ſomewhat longer than the other; put the ſhorter end of it into the veſſell of water, and let the longer end hang out of the veſſell, unto which longer end, put your mouth, and draw in your breath, and the water will follow; then withdraw your mouth, and you ſhall ſee the water runne ſo long, till it come equall to that end of the Cane which is within the veſſell.

Another.

TAke a deepe veſſell, having two loopes on one of the ſides, fill it nigh full with water: then take a hollow Cane, like unto the aforeſaid, but let there be faſtened unto the ſhorter end a woodden diſh; put the longer end

heereof through the loopes on the ſide, and that end that hath the diſhfaſtened unto it into the veſſell of water, with your mouth as you did in the former, draw out the aire, and you ſhal ſee that as the water runneth out, the Crane will ſinke lower and lower, and ſo will continue running until the veſſell be drawne empty.

How to make a conceited pot, which being filled with water, will of it ſelfe runne all out; but not being filled will not run out.

MAke, or cauſe a pot to be made of what faſhion beſt liketh your minde, and make a large hollow Cane to ſtand up in the midſt thereof; having at the bottome two or three ſmall holes; let the top of this cane be cloſe: then make a hole in the bottome of the veſſell, and put up a little cane hollow at both ends, into the other Cane, ſo that the one end therof may almoſt touch the top of the great cane, and it is done. Note, that if you put into this veſſell ſo much liquor, that it ſwim aboue the top of the Cane, it will of its owne accord, runne, and never ceaſe ſo long as there is any liquor in the veſſell; but if you fill it below the cane, it will not run at all of it ſelfe: the reaſon whereof is this; the ayre being the lighter element, doth aſcend into the higher place, but being drawne as in the two firſt demonſtrations out of the Crane, or forced, as in this, by the weight of the Water in the veſſell, the water then tendeth downewards unto its proper place.

Another conceited Pot out of which being first filled with wine and water, you may drinke pure wine apart, or faire water apart, or els both together.

LEt *M* signifie a pot having a partition in the middle as you may see in the figure, which must have divers little holes bored through: the handle of this pot must bee hollow quite through; and the lower end thereof must passe through the side of the pot; and also the partition that is within the pot. It is noted with the letters q and r: if you fill the lower part of this pot with water, and then with your finger, stop the hole r, at the top of the handle, and then fill the upper part with wine, neither of both will mix together. But if you withdraw your finger from the hole r at the top of the handle, you may drinke out of the said pot both wine and water mixed together, with this pot you may welcome unbidden guests, having the lower part ready filled with water, cal to your servant to fil your pot with wine, then may you drink unto your guest, drinking up all the wine, who when he takes the pot thinking to pledge you in the same, and finding the contrary, will happily stay away until he be invited, fearing that his next presumption might more sharply be rewarded.

How to dispose 2 vessels upon one foot, that so much wine may run out of the one, as you shall put water into the other.

LEt A,B,C,D,be the foot,at each end whereof, place a vessell equall in bigneſſe,the one to the other; as D, E, alſo let there paſſe a hollow Cane from the one to the other,as A,R,A, the ends whereof muſt almoſt touch the tops of the ſayd veſſels; in the veſſell D, there muſt be a hollow pipe,as F,wherby you may by help of a tunnell powre water into the veſſel, alſo in the veſſell E, there muſt be a crane as G.The mouth of the veſſel,D,muſt be cloſe ſtopped, and the pipe F,muſt paſſe through the ſtoppel; now if you fil the veſſell E with wine almoſt unto the top of the Crane, and afterwards ſtop the mouth of the veſſell, that the ayre may not breath forth, it will not run of it ſelfe;but if you put water into the veſſell D,the ayre contained in it, will paſſe through the hollow pipe, A,R,A,into the veſſell E,where ſtriving for a greater quantity of roome,it preſſeth the wine out of the veſſel E, (by the crane)anſwereable in quantity unto the water powred into the veſſell D.

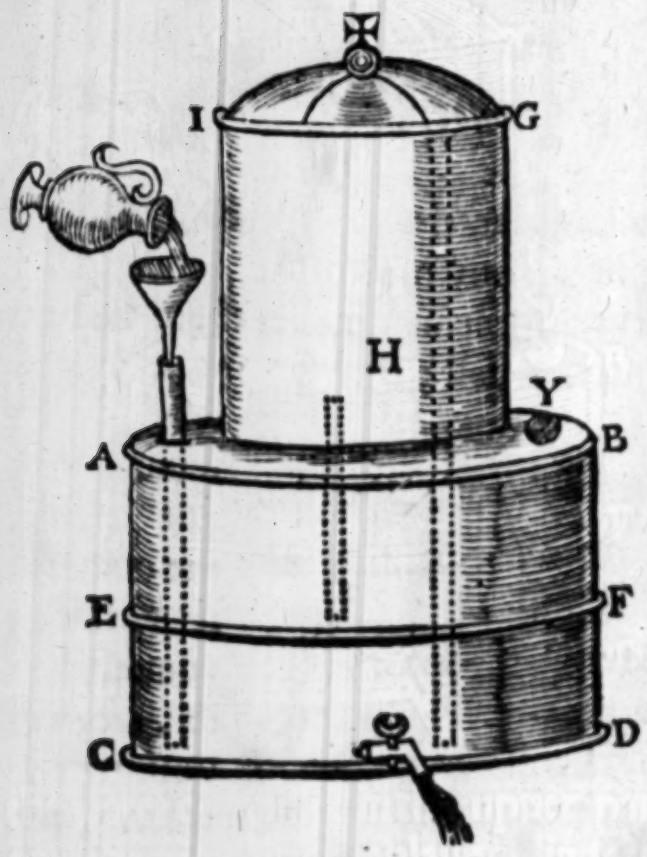
How to diſpoſe 2 veſſels upon one foot, the one being empty, and the other almoſt full of wine, and yet ſhall not run out of the veſſell, unleſſe you fill the empty veſſell with water, and then the one ſhall run pure wine, the other fayre water.

LEt there be two veſſels placed upon one foot, having a hollow cane paſſing from one to the other (as I taught in the precedent probleme) but let there be two cranes, as F, G, one in each veſſell; then fill one of the veſſells with wine, but not above the crane, ſo it will not runne of it ſelf: but if you powre water into the other veſſell, untill it be ful, it wil cauſe that wine ſhall run out of the one, and cleare water out of the other.

To make that the water contained in one veſſel, ſhall aſcend into another veſſell placed above it.

LEt, A, B, C, D, be a veſſell having a partition in the middle, as E, F, let there be placed upon this veſſell, a Cylinder of Glaſſe cleare, and very tranſparant, that will containe the ſame quantity of water, that one of the partitions

tions wil,as I,G,H; & in the lowermoſt partition towrds the bottom,let there be a cocke,and out of the ſame veſſell let two pipes be made to paſſe, the one whereof reacheth almoſt to the top of the Cylinder, the other muſt come out by the ſide of the Cylinder: alſo out of the upper partition there muſt come another pipe. Moreover there muſt be a hole, thorow the top of the uppermoſt partition as Y. Which ſo ſoon as the upper partitiõ is filled with water muſt be cloſely ſtopped. Fill the lower partition at the pipe, alſo the upper partition by the hole Y: note then that if you turn the cock as thef water runneth out o, the lower partition the water contained in the upper partition wil aſcend thorow the pipe into the glaſſe cylinder. When al the water in the lower partiton is run out at the cocke, then the water which before did aſcend into the Cylinder, will fall back again into the upper partition: after this manner may you compoſe an artificiall water clocke,if you note the houres upon the Cylinder,and make the cocke after ſuch manner as that the water may iſſue out but by drops.



How

How to convey water over a mountaine.

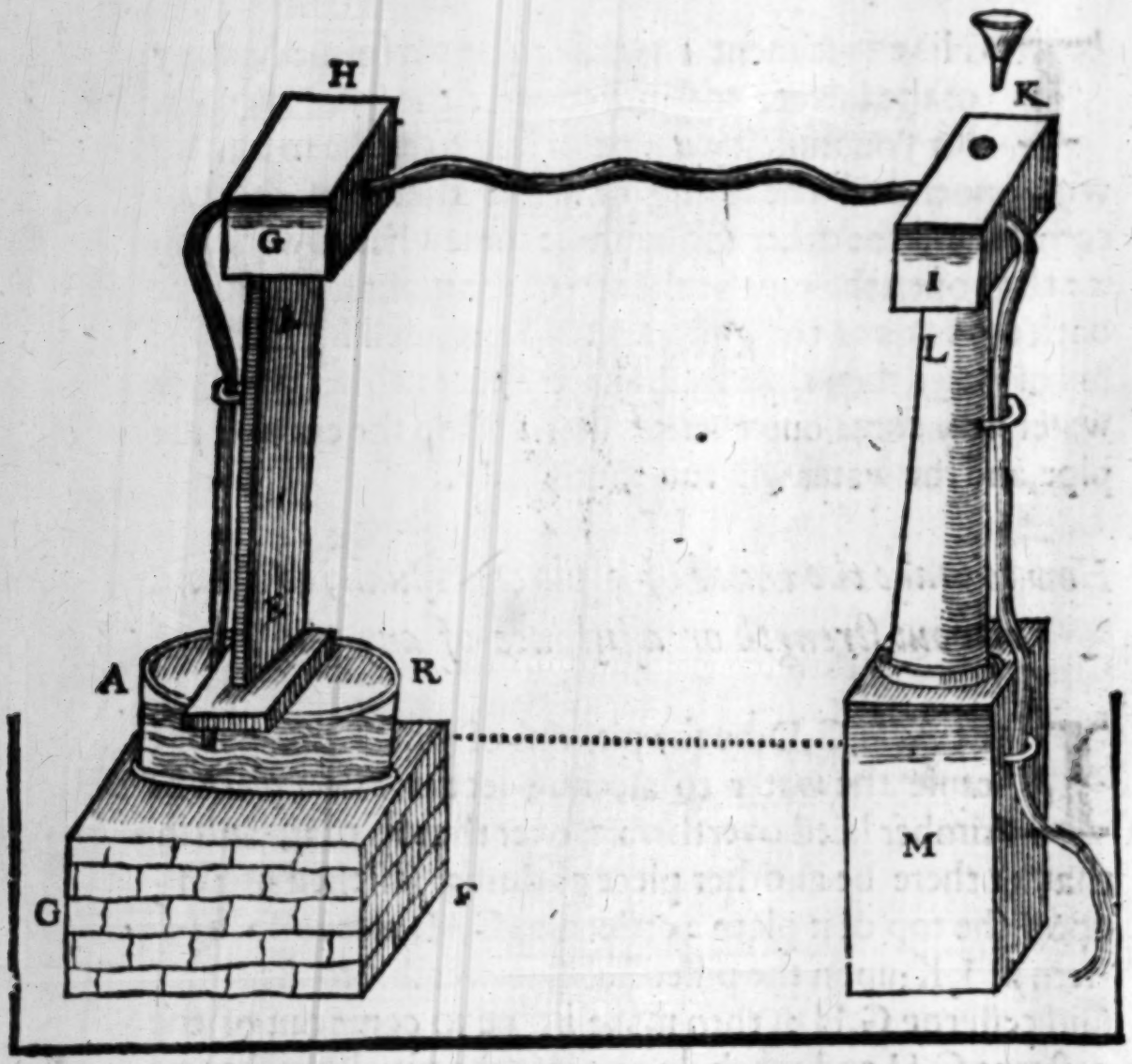
THis experiment is as easie to be performed, as any of the former, and indeed after the same manner, for you must lay a pipe of lead over the mountain with one end in the spring or water that you desire to convey, and the other end must lie somewhat lower than it: then open the pipe at the top of the mountaine, stoppe both the ends of the pipe, and with a tunnell fill the pipe full of water, then close it up exactly, that neither ayre nor water may come out thereat, then unstop the ends of the pipe, and the water will run continually.

How to make the water of a pit continually to ascend without strength or assistance of any pumpe.

LEt A, B, C, D, be the pit, out of which you would cause the water to ascend; let there be a piece of timber laied overthwart over the top of it, and in that let there be another piece of timber fastened, as E, F; upon the top of it place a cestern, as G, H; place also a cestern as I, K; upon the piller L, M, answerable to the aforesaid cesterne G, H: then make a pipe to come out of the cesterne G, H, and reach downe into the pit: also make another pipe to come out of the cesterne I, K, and to descend by the side of the pillar L, M: and to the lowermost end let there be fastened a cocke, and this end must descend lower than the end of the other pipe, then make another pipe to passe from one cesterne to another and its done when you would occupy it, fill the cestern I, K, full of wa-

ter

ter with a tunnel, and ſtop it afterwards cloſe with a cork; then turne the cocke, and as the ceſterne I, K, emptieth, it will be ſupplied by the water in the Ceſterne G, H; and

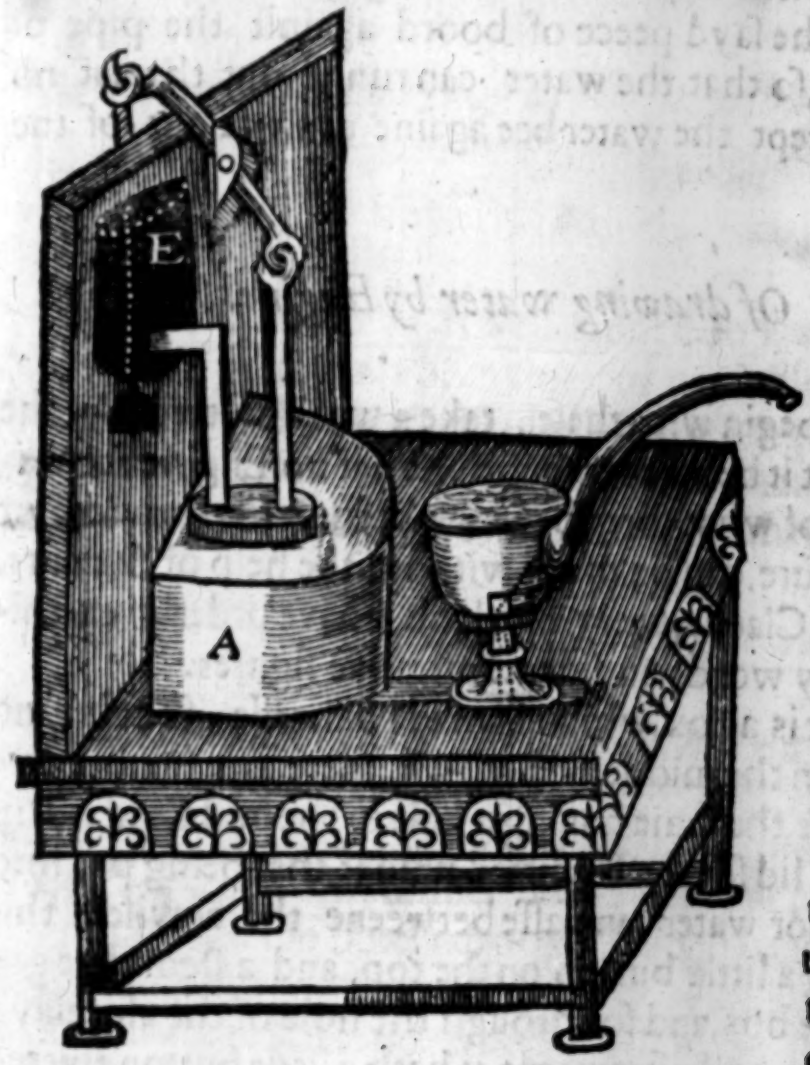


as G, H, emptieth, it will bee ſupplied by the water in the well or pit.

To

To make a cup or veſſell that ſo oft as you take the liquour out of it, ſo oft it ſhall fil it ſelfe, but never run over.

SVppoſe A to be a veſſel ful of water, having a pipe coming from the bottome, and riſing up into a cup of the iuſt height that the veſſell is of; over the veſſell fild with water, let there be placed another veſſell, as E. From this veſſell muſt come a pipe and reach within the other veſſel. Now over this veſſell there hangeth, as it were the beame of a ſcale; at the one ende whereof, is faſtened a peece of boord, having a leather nailed upon the top; at the other end of



of this beame muſt hang a weight, but not full ſo hea-
uie as the piece of boord lethered is. Fill both theſe veſ-
ſels with water, and the cup alſo; note then, that if you
ſucke out the water in the cup by the pipe on the ſide of
it, the water in the veſſell will come into it, untill it is in
both of equall height: now as the water falleth down in
A, the peece of boord that is hanged unto one end of the
beam falleth after it (becauſe it is heavier than the weight)
and ſo giveth way unto the water in E, which runneth in-
to it; and when the veſſell is filled againe with water, it
beareth up the ſayd peece of boord againſt the pipe of
the veſſell E, ſo that the water can runne out thereat no
longer, except the water bee againe drawne out of the
cup.

Of drawing water by Engines.

BEfore I begin with theſe, take a word or two by the
way. Let it be a general notion that no Engine for wa-
ter workes of what ſort ſoever, whether for ſervice, or
meere pleaſure, can be made without the help of Succurs,
Forcers, or Clacks; every of which, I have orderly explai-
ned both by words and demonſtrative figures.

A Succur is a box, which is made of braſſe (having no
bottome) in the middeſt of which, there is a ſmall barre
goeth croſſe, the ſame having a hole in the middle of it; this
box hath a lid ſo exactly fitted unto it, that being put into
it, no aire nor water can paſſe betweene the creviſe: this
cover hath a little button on the top, and a ſtem that go-
eth into the box, and ſo through the hole of the aforeſayd
croſſe barre, and afterwards it hath a little button riveted
on

on it, ſo that it may with eaſe ſlip up and downe, but not be taken, or ſlip quite out.

A Forcer is a plug of wood exactly turned and leathered about, the end that goeth into the barrell, is ſemicircularly concave.

A Clacke is a peece of leather nayled over any hole, having a piece of lead to make it lie cloſe, ſo that the ayre or water in any veſſell may thereby be kept from going out.

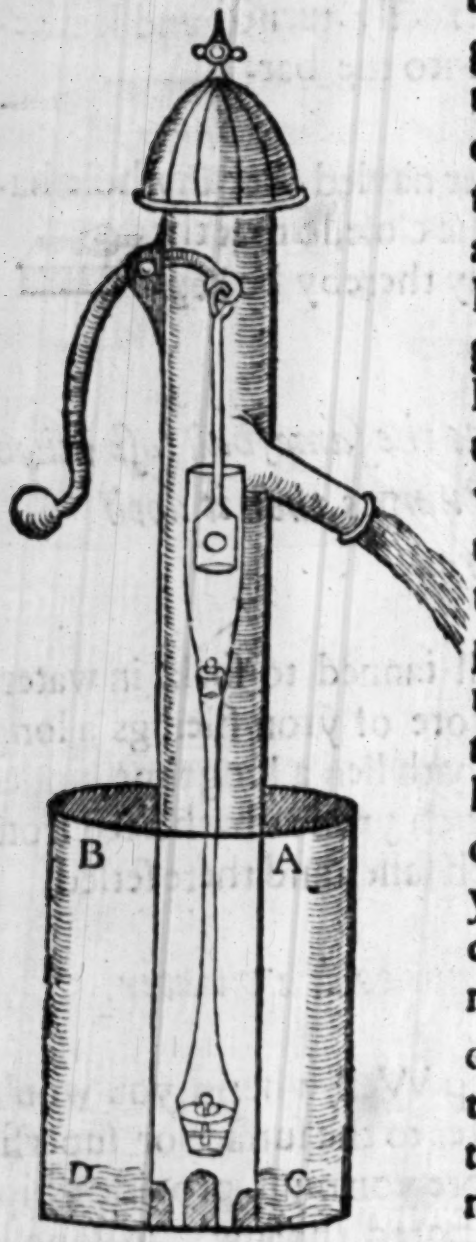
How to harden Leather, ſo as the ſame ſhall laſt much longer in ſuccurs of Pumpes, then it doth unprepared

LAy ſuch Leather as is well tanned to ſoake in water, wherein there hath been ſtore of yron fileings a long time, or elſe in the water that hath lien a long time, under a grindſtone, into the which ſuch yron as hath been from time to time ground away, hath fallen and there ſetled,

The making of a Pumpe to draw water.

SVppoſe A, B, C, were a deep Well, wherin you would make a pumpe to draw water to the ſurface or ſuperficies of the earth. Firſt therefore yon muſt provide a pipe of Lead, or a peece of timber bored thorow, ſo long as will reach unto the bottome of the Well: that part that ſtandeth in the water muſt bee cut with two or three arches, as it were, if it bee wood; if Leade, it muſt have ſomewhat to beare it a little from the bottome, that the water may thereby bee let into the pipe. Towards the

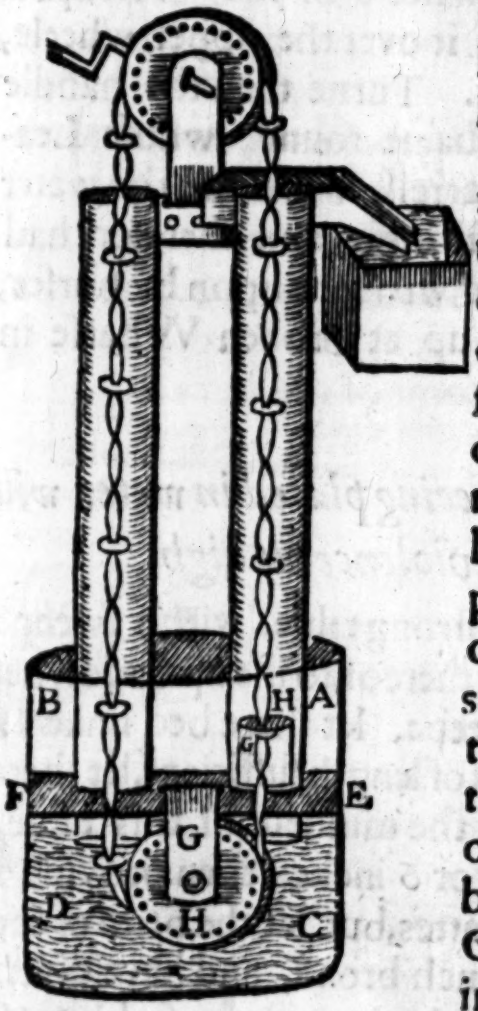
bottome of the pipe in the water there muſt be faſtened a ſuccur: alſo another of theſe ſuccurs muſt be faſtned about two foot above the top of the ground: then have a bucket fitted unto the hole of the wood or leaden pipe, let it bee wel leathered about, and have a clacke at the bottom of it, and let it be hanged with a ſweep as the figure ſhewes: note that after you have filled the diſtance between the lower ſuccur, & the bucket with water, that if you lift up the ſweepe, it wil thruſt downe the bucket upon the water, and preſſe it, the water being preſſed upon by the bucket, beareth up the clack, that is faſtened in the bottome of the bucket, and ſo comes into the bucket: then if you pull downe the ſweepe, the clacke ſhutteth, and ſo the water remains in the bucket, that being drawn upward, there being nothing to follow but water, both the ſuccurs open, and there commeth into the pumpe ſo much water as the buckets drew up: ſo ſoon then as you lift up the ſweep againe, the water beareth up the clack again, and there being no place for the water formerly contained in the bucket to fall backe into, it muſt of neceſſity riſe above the bucket, and ſeek for paſſage ſome other where.



The

The making of an Engin, whereby you may draw water out of a deepe well, or mount any River water, to be conveyed to any place within three or four miles of the same. Also it is used in great ships which I have seene.

SVppose, A, B, C, D, to be a deepe Well, and EF to bee a strong peece of timber fastned athwart the same, a good way in the water. In this planke let there bee fastened a peece of timber with a strong wheele in it, as G, H, having strong yron spikes drove athwart the wheele within the crevise, and strongly riveted on each side: let them be three or foure inches distant from each other. Let there bee likewise made in the sayd planke two holes, in which set two hollow posts, that may reach to the top of the Well, or so much higher syou desire to mount the water; let them be made fast that they stirre not. In the bottome of one of these posts, there must be fastned a barrell of brasse, as GH, made very smooth within; and betwixt those two posts at the top; let there be fastened unto them both another

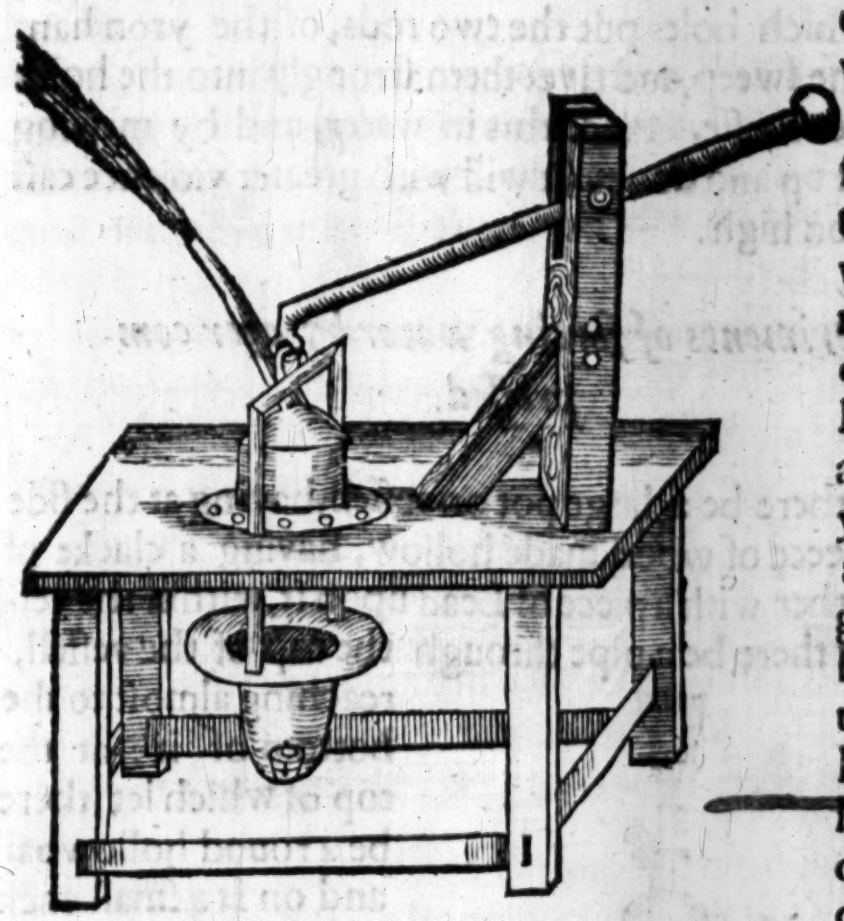


peece of ſtrong timber to hold them faſt, leſt they ſtart aſunder; and in the middeſt of that make a mortice, and init faſten a ſtrong peece of timber with a wheele like to the former mentioned; the pin whereof ought to be made faſt unto the wheele, and have a crooked handle to turne about, that by turning of it, you may turne the wheele alſo. Then provide a ſtrong yron chayne of length ſufficient, having on every third or fourth linke a peece of horn, that will eaſily go through the braſſe barrell, and a leather on each ſide of it, but ſomwhat broader then the horne, put this chayne under the lower wheele in the Well upon both the hollow poſts, draw it over the upper wheele, and linke it faſt and ſtraight. Turne then the handle round, and it will turne the chaine round, whoſe Leathers comming up the braſſe barrell, will beare the water before them; this goeth very ſtrongly, and therefore had need be made with wheeles and wrought upon by horſes, for ſo the water is wrought up at Broken Wharfe in London.

To make an Engine, which beeing placed in water will caſt the ſame with violence on high

LEt there be prepared a ſtrong table, with a ſweepe faſtened at the one end thereof, to liſt up & downe, unto the end of the ſweepe, let there bee linked a peece of yron having two rods of length ſufficient, let there be made a hole quite through the middeſt of this table, whoſe diameter let be about 5 or 6 inches: then provide 2 peeces of braſſe in forme of hattes, but let the brim of the uppermoſt be but about one inch broad, and have divers little holes round about it: alſo in the crown of this muſt

bee



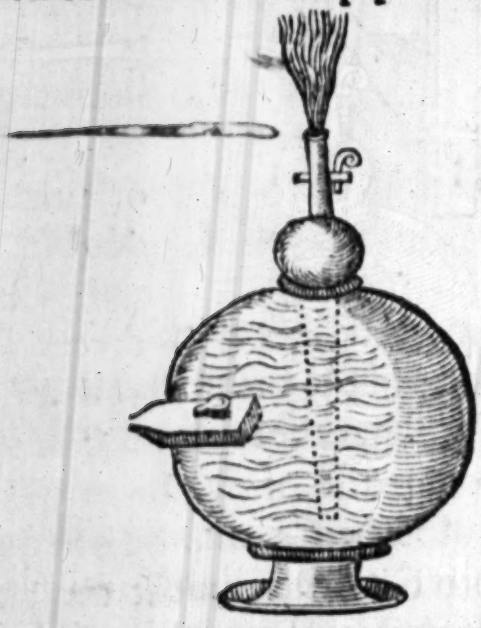
be placed a large ſuccur, & over it a halfglobe from the toppe of which, muſt proceed a hollow trunk about a yard long, and of a good wide bore, then take good liquoured leather, 2 or 3 times double, & put between the boord and the brims of this, & with divers little ſcrews put through the holes of the brim, ſcrew it faſt unto the top of the table. Note that the table muſt be leathered alſo underneath the compaſſe of the brim of the lower braſſe. Now the lowermoſt braſſe muſt be of equal diameter (in hollowneſſe) unto the other, but it muſt bee more ſpirall towards the bottome, and muſt have either a large clacke or ſuccur faſtened in it: alſo the brimme of this muſt be larger than that of the uppermoſt, and have two holes made about the midſt on each ſide one: bore then 2

holes

holes in the table, on each side of the brasse one, answe r-ble unto the holes of the brimme of the lower brasse, through which holes put the two rods, of the yron hanged unto the sweep, and rivet them strongly into the holes of the lower brasse. Place this in water, and by moving the sweepe up and downe, it will with greater violence cast the water on high.

Experiments of forcing water by ayer compressed.

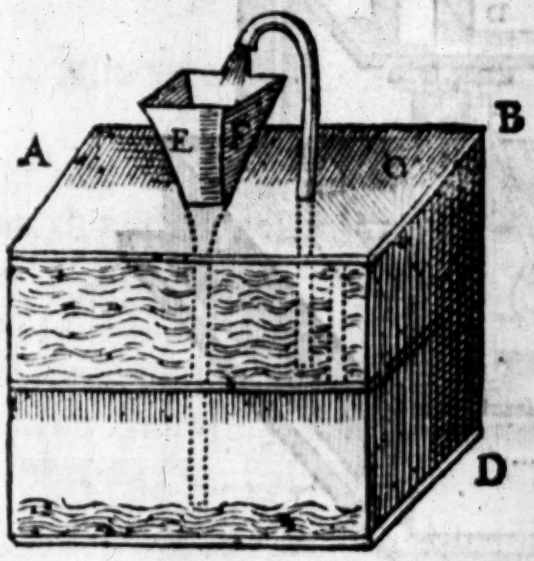
LEt there be a large pot or vessell, having at the side a peece of wood made hollow, having a clacke of leather with a piece of Lead upon it, within the vessell also let there be a pipe through the top of the vessell, reaching almost to the bottom of it: at the top of which let there be a round hollowbal and on it a small cock of brasse. Note that if you fill the said vessell halfe full of water, & blow into the hole of the pipe, at the side, your breath wil lift up the clacke, and enter the vessell, but when it is in, it will presse down the clacke. blow into it oftentimes, so shall there be a great deale of ayre in the vessell, which will presse so hard upon the water, that if you turn the cock at the top, the water in the vessell wil spinne out a good while.



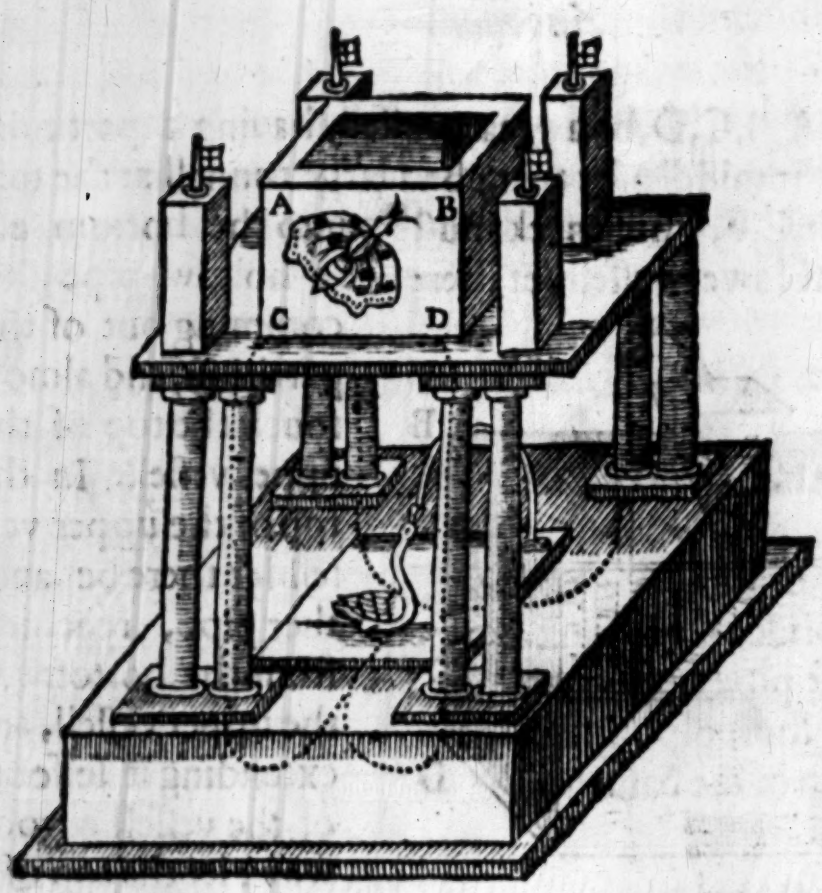
Another

Another.

LEt A,B,C,D, be a great veſſell, having a partition in the middle: let there be a large tunnell at the top of it, E,F, whoſe neck muſt go into the bottom almoſt of the lower veſſell; let there bee a hollow pipe alſo



comming out of the partition, and almoſt touch the top of the upper veſſell. In the top of the upper veſſell let there be another pipe, reaching from the bottome of the upper veſſell, and extending it ſelfe out of the veſſell a good way: let the top of it hang over the tunnell. In the top of the upper veſſell let there be a hole beſides, to be ſtopt with cork, or otherwiſe: when you will uſe it open the cork hole, and fill the upper veſſell with water: then ſtop it cloſe again, and powre water into the tunnell, and you ſhall ſee that the water in the upper veſſell will run out of the pipe into the tunnell againe, and ſo wil continue running untill all the water in the upper veſſell be run out. The reaſon thereof is this; the water in the tunnell preſſing the ayre in the lower veſſell maketh it aſcend the pipe in the partition, and preſſe the water in the upper veſſell, which having no other way but the pipe, it runneth out thereat.



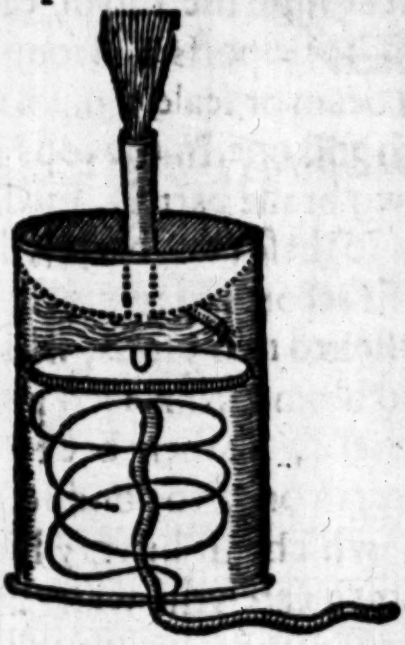
The forcing of water by pressure, that is the naturall course of water in regard of its heavinesse and thinnesse, artificially contrived to breake out of what image you please.

LEt A,B,C,D, be a cesterne placed upon a curious frame for the purpose, let the bottom of this frame be made likewise in the form of a cestern: through the pillers of this frame let there passe hollow pipes from the bottom of the upper cestern, and descend to the bottom of the lower cesterne, and then run all to the middle there-

thereof, and ioyne in one, and turn up into the hollow body of a beaſt, bird, fiſh, or what your fancy moſt affecteth: let the hole of the image whereat the water muſt breake out, be very ſmall, for ſo it will run the longer. Fill the upper ceſtern with water, and by reaſon of the weight thereof it will paſſe through the pipes, and ſpin out of the hole of the image.

Experiments of forcing water by Engins.

LEt there bee an even ſtraight barrell of braſſe of what length and bigneſſe you pleaſe: let the bottome of it be open, and let the top be cloſed, but ſo that it be hollow on the out-ſide like a baſin: in the midſt whereof let there be a ſtraight pipe erected, open at both ends, alſo let there be another ſhort pipe at the ſide of it; which let bee even with the top of the baſin on the outſide, but ſtand a little from it on the ſide. Having thus prepared the barrell, fit a good thick board unto it, ſo that it may ſlip eaſily up & downe from the top of the barrell unto the bottom, nayle a leather about the edges of it, and another about the top of it: on the under ſide of it let there bee faſtened a good ſtiffe, but flexible ſpring of ſteele, which may thruſt the board from the bottome to the top of the barrell: let the foot of this ſpring reſt upon a bar faſtned acroſſe the bottome of

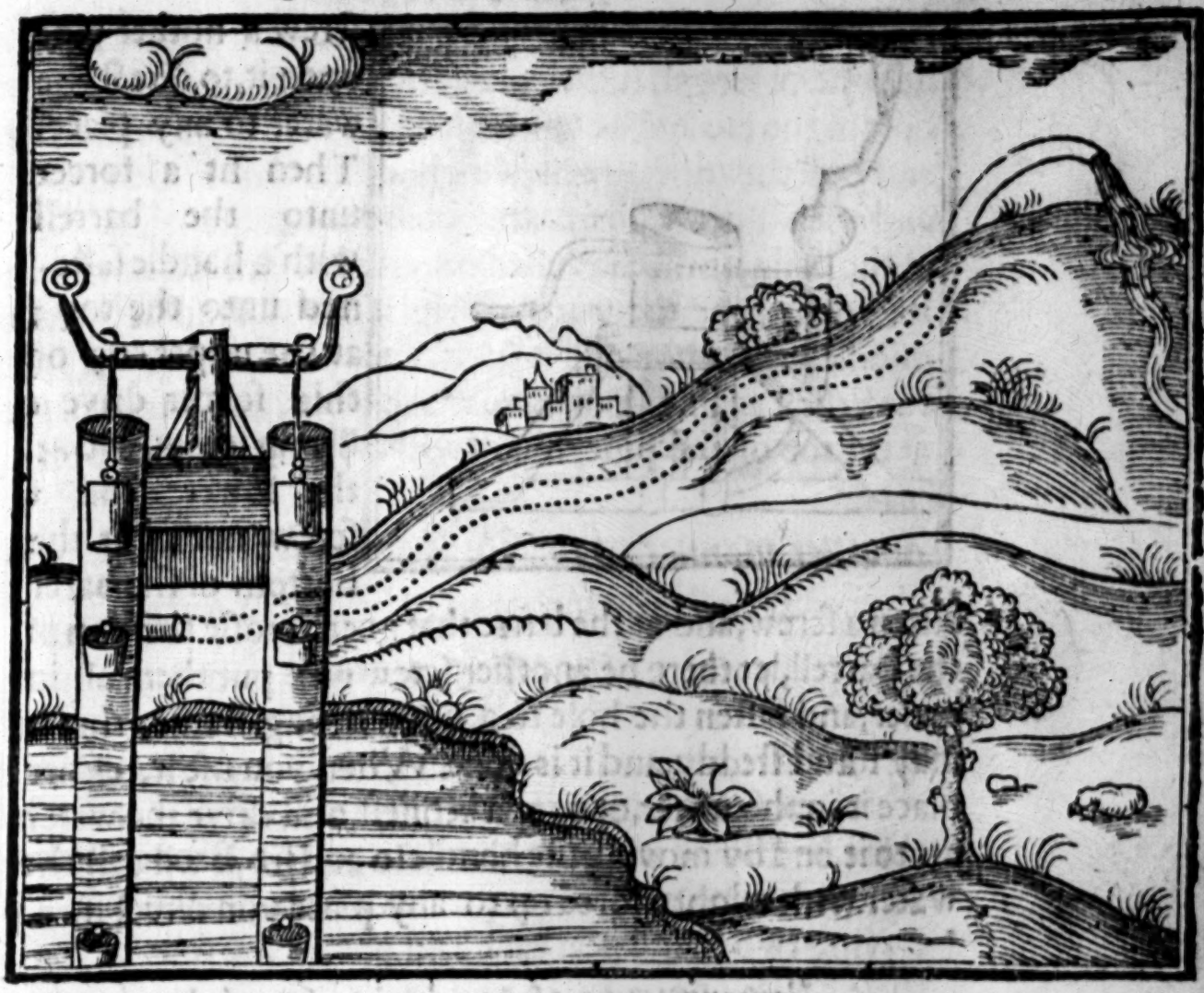


the barrell; let this board also have tied at the middle a little rope of length sufficient. When you use it, bore a little hole in the table that you set it on, to put the rope thorow and pull the rope downe, which will contract the spring, and with it draw downe the board: then poure in water at the basin untill the vessell be full: Note then, as you let slacke the rope, the water will spirt out of the pipe, in the middle, and as you pull it strait, the water will runne into the vessell againe. You may make birds, or divers images at the top of the pipe, out of which the water may break.

Another manner of forcing water, whereby the water of any spring may be forced unto the top of a hill.

LEt there be two hollow posts, with a succur at the bottom of each, also a succur nigh the top of each: let there be fastned unto both these posts a strong piece of timber, having, as it were, a beam or scale pinned in it, and having two handles, at each end one. In the tops of both these hollow posts fasten two brasse barrels, made very even and smooth within, unto these two barrels let there be fitted 2 forcers, leathered according to art, at the tops of these forcers must be fastened two yrons, which must be linked unto the afore said beame; from each post below towards the end of the barrells, let there bee two leaden pipes, which afterward meet in one, to conduct the water up to the place desired, which if it be very high, there will be need of some succurs to catch the water as it commeth.

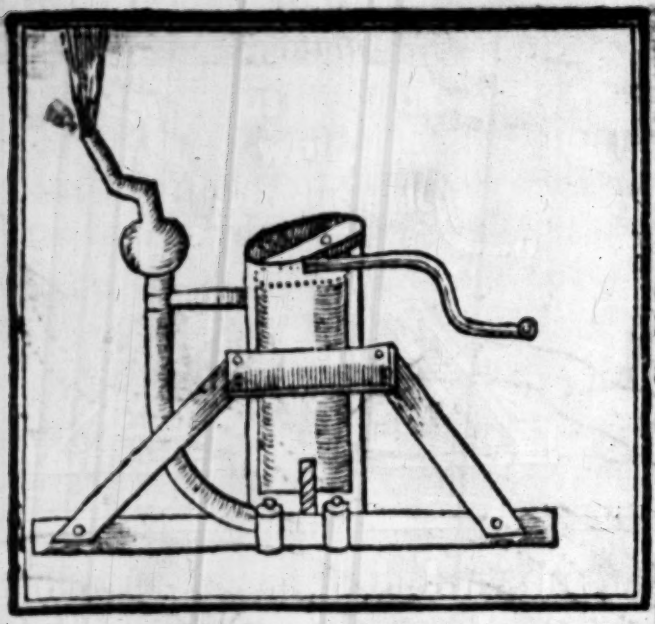
The



The deſcription of an Engine to force water up to a high place: very uſefull for to quench fire amongſt buildings.

LEt there be a braſſe barrell provided, having two ſuccurs in the bottome of it: let it alſo have a good large pipe going up one ſide of it with a ſuccur nigh unto the toppe of it, and above the ſuccur a hollow round ball, having a pipe at the toppe of it made to

ſcrew

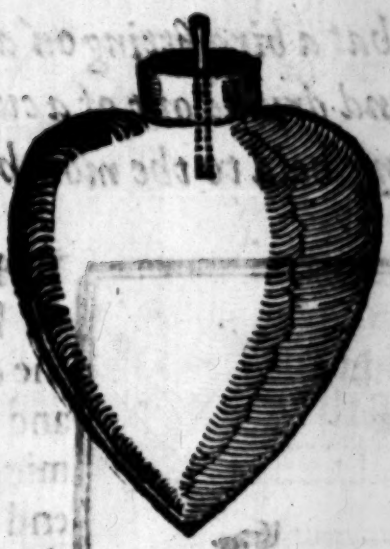


ſcrew a nother pipe upon it, to direct the water to any place. Then fit a forcer unto the barrell with a handle faſtened unto the top; at the upper end of this forcer drive a ſtrong ſcrew, and at the lower end a ſcrew nut, at the bottom of the barel faſten a ſcrew, and at the barre that goeth croſſe the top of the barrell, let there be another ſcrew nut: put them all in order, and faſten the hole to a good ſtrong frame, that it may ſtand ſteddy, and it is done. When you uſe it, either place it in the water, or over a kennell, and drive the water up to it, and by moving the handle to and fro, it wil caſt the water with mighty force up to any place you direct it.

Experiments of producing ſounds by ayre and water.

LEt there be had in a readineſſe a pot made after the forme of the figure following, having a little hole at the top, in the which faſten a reed or pipe, alſo another little hole at the bottome: preſſe this pot into a bucket of water, and it will make a loud noyſe.

Another



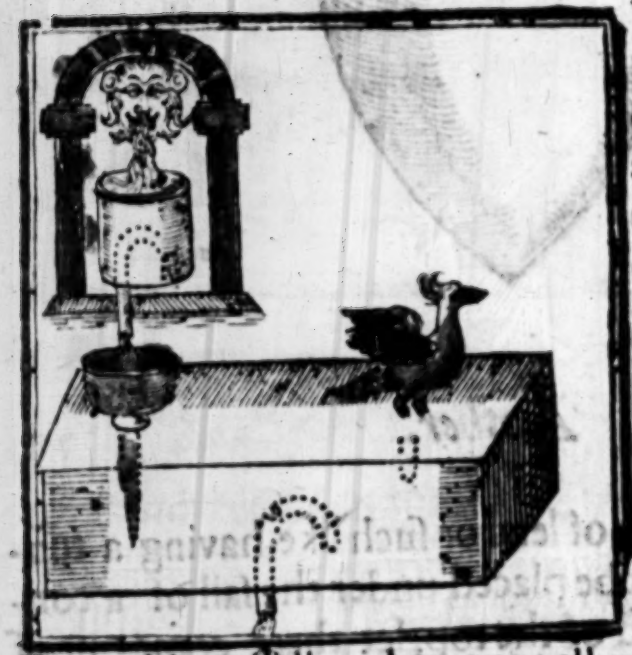
Another.

LEt there be a ceſtern of lead or ſuch like, having a tunnell on the top: let it be placed under the fall of a conduit, and at the one end of the top, let there come out of the veſſeil a ſmall pipe, which let be bent into a cup of wa-

ter, and there will be heard a ſtrange voyce. Over this pipe you may make an artificiall tree with divers birds made to ſit therein.

How

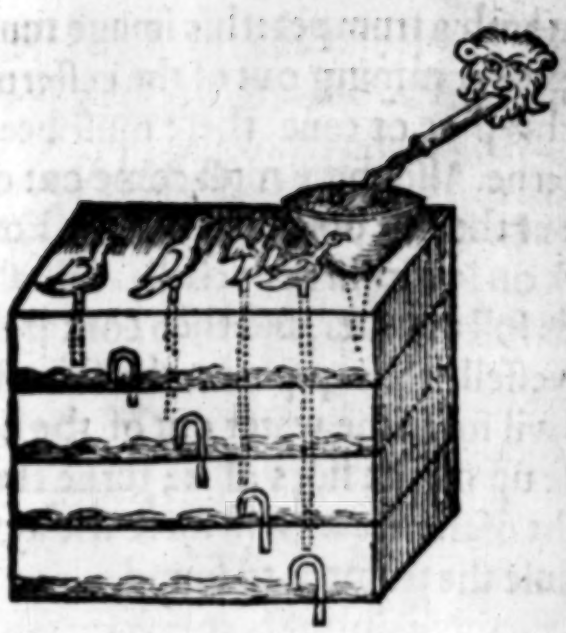
How to make that a bird ſitting on a baſis, ſhall make a noyſe, and drinke out of a cup of water, being held to the mouth of it.



PRovide a ceſterne, having a tunnell at the one end of the top, and a little cane comming out of the other end of the veſſell; on the toppe of which let there be a bird made to ſit, alſo at the bottome of the ceſterne, let there bee a crane to carry away the water as it runneth into the veſſell: Place this veſſell with its tunnell under the fall of a conduit of water, and the bird will ſing; and if you hold a cup of water under his bill, hee will drinke and make a noyſe.

A device whereby ſeverall voyces of birds cherping may be heard.

PRepare a ceſterne having divers partitions, one above another; let them all have cranes in the bottomes to carry the water from one to another; alſo let each ceſtern have his ſeverall pipe, all of them comming out at the top of the ceſtern, on whoſe tops let birds be artificially made, with



with reeds in them: alſo in the top of the upper ceſtern let there be a tunnell. Place it under the fall of a conduit of water, and you ſhall heare ſo many ſeverall voyces as there are birds.

A device whereby the figure of a man ſtanding on a baſis ſhall be made to ſound a trumpet.

PRepare a ceſtern having within on the lid faſtned a concave hemiſphere in whoſe bottom let there bee made one or two holes: let there alſo be a hole in the top of the ſaid ceſtern, whereby it may bee filled with water as occaſion ſerveth, alſo let there be made to ſtand on the top of this ceſtern the image of a

man holding unto his mouth a trumpet: this image must likewise have a slender pipe comming out of the cesterne unto the trumpet, in this pipe or cane there must bee a cocke nigh vnto the cesterne. Also there must come out of the concave hemisphere at the side of the cesterne, a little short pipe having a clack on it within the vessell. Fill the cesterne about two thirds full of water, and then cork it up fast, blow then into the vessell at the pipe on the side divers times, and the ayre wil force the water out of the hemisphere, and make it rise up on the sides of it; turne then the cocke, and the weight of the water will force the ayre out of the pipe, and so cause the trumpet to sound.

Hercules shooting at a Dragon, who as soone as he hath shot, hisseth at him.

LEt there bea cestern having a partition in the middest, in the partition let there bee a deepe succur, having a small rope fastned unto the top of it: let the one end of the rope come out of the upper lid of the cestern, and bee fastened unto a ball, the other part thereof let it be put under a pulley (fastned in the partition) and let it be carried also out of the upper cestern, and be fastened unto the arme of the image, which must bee made to slip too and againe, and to take hold of the string of a steele bow that is held in the other

other hand. At the other end of the ceſtern let there bee made an artificiall image of a Dragon, through whoſe body muſt come a ſmall pipe with a reed artificially faſtned in the upper part thereof. Note then, that when you put up the ball, the image will draw his bow, and when you let it fall, the Dragon will hiſſe.

Experiments of producing ſounds by evaporation of water by ayre.

PRepare a round veſſell of braſſe or lattin, having a crooked pipe or necke, whereto faſten a pipe: put this veſſell upon a trevet over the fire and it will make a ſhrill whiſtling noyſe.

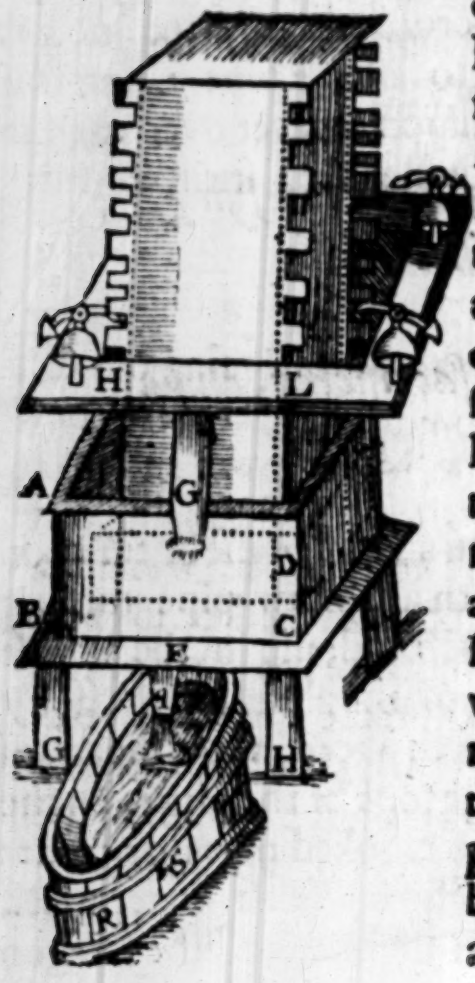
To make two images ſacrificing, and a Dragon hiſſing.

PRepare a ceſtern having an altar of braſſe or tin upon it, let there be in the ceſtern a hollow pipe turning up out of the ceſtern at each end; alſo in the middle within the altar, alſo on the ſide of the altar into the body of a Dragon artificially made, with a reed in the mouth of it. Let there be two boxes at the tops of the pipes, on the ends of the ceſterne, having two crooked pipes or cranes comming out of them. Fill the boxes with water when you occupy it, alſo put fire upon the altar, and the Dragon will hiſſe, and the water in the two boxes being wrought

upon by the heat of the fire commiug thorow the pipes will drop into the fire. Theſe two boxes ought to bee incloſed in the bodies of two images, and the two ſhort cranes comming out of them in her armes and hands.

Experiments of producing ſounds by Engins.

PRepare a veſſel after the form of the figure marked with the letters A,B,C,D, place it upō a frame as F, G,H; this veſſel muſt have a hole in the bottom, with a pipe faſtned in it, as Q, to convey the water contained in it into a veſſell or tub ſet under it, marked with the letters R,S,T, alſo a frame muſt bee faſtned at the top of it, as G,H, L, having ſo many bels with little beaters or hammers to them (artificially hanged) as are requiſite to expreſſe your deſired tune. Laſtly provide a ſollid piece of timber, whoſe lower part muſt be fitted unto the aforeſayd veſſell, ſo that it may eaſily ſlip up and downe, and ſo high, as that its foot reſting upon the bottome of the veſſell, the upper part thereof may ſtand ſomewhat above all the bels. Note likewiſe that that part of this wood above its bottome or foot muſt bee cut away about three quarters of

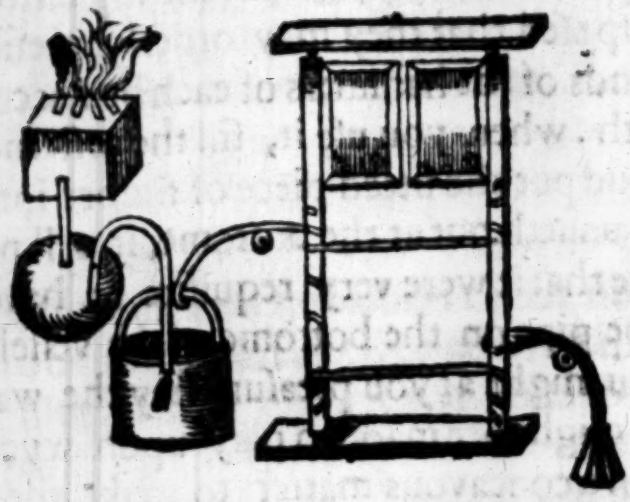


an

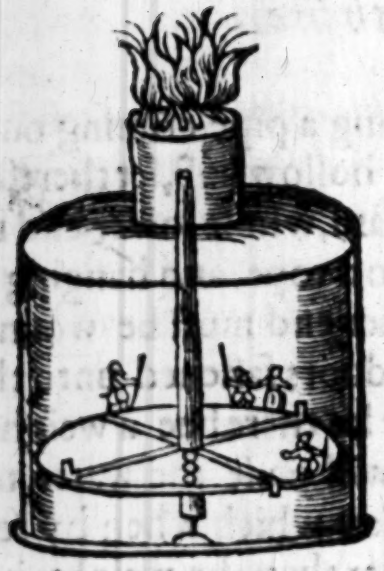
an inch. Vpon this wood thus fitted muſt bee faſtened ſeverall pins equal unto each bel, from the top unto the foot thereof, ſo diſpoſed that they may orderly preſſe downe the inward ends of the hammers of each bell, according as the tune goeth. when you uſe it, fill the ceſterne almoſt with water, and put the fitted piece of timber into it, and as the water runneth out at the bottome, it will play upon the bels: note that it were very requiſite to have a cocke faſtened to the pipe on the bottome of the veſſell, that therewith you might at you pleaſure ſtay the water. The like Engines might bee made to play upon wyer ſtrings diſpoſed upon a concavous matter to make the muſicke reſound, but becauſe this deſcription giveth light enough for the framing of divers other, I thought good here to omit them.

Experiments of motions by rarifying water with fire.

LEt there be an altar having a pipe cõming out of it & entring the body of a hollow ball, let there come out of the ſame bal a beam, whoſe lower end make to hang over a bucket faſtned to a rope, and hanging over a pulley, of which rope the other end muſt be wound about two ſpindles, having two doors faſtened unto them, and at the end of the ſame rope let there bee a weight faſtened. So the fire on the altar will cauſe the water to diſtill out of the ball into the bucket, which when by reaſon of the water it is become heavier than the weight, it will draw it up, and ſo open the ſayd gates or little doores.



Experiments of motions by rarifying ayre by fire.



LEt there bee a round veſſell of glaſſe, or horne, and on the top of it a veſſell of braſſe, and in the middeſt a hollow pipe ſpreading it ſelfe into four ſeuerall branches at the bottome: the ends of two of the branches muſt turn up, the ends alſo of two muſt turne downe; upon theſe foure branches faſten a light card, with ſeverall images ſet upon it. Rarifie the aire then by laying a red-hot iron upon the top of the braſſe or tin veſſell, and it wil turne

turne the wheele about, ſo that you would thinke the images to be living creatures by their motion.

Another way.

FIrſt prepare a round peece of wood, having a braſſe box in the midſt, ſuch as they make to hang the mariners compaſſe with, but a good deale bigger, round a bout this peece of wood faſten divers ſhreds of thin lattin, ſtanding obliquely or askew, as the figure doth repreſent; round a-

bout theſe faſten a coffin of thinne paſtboord, cut into ſeveral formes of fiſhes, birds, beaſts, or what you pleaſe. Prepare a lanterne with oyled parchment, ſufficient to contain it, in the middeſt of whoſe bottome muſt be erected a ſpindle with a narow point, to hang the paſtbord cut into forms upon: upon each ſide let there be a ſocket for to ſet a candle in, alſo let ther be made a dore in the bottom to put the candles in at, and after to be ſhut, and it is don. If you ſet two candles in the ſockets, the heat of them will turn the whole paſtboord of forms round.

A

A conceited Lampe having the image of a Cocke sitting on the top, out of whose mouth by the heat of the Lampe, either water or ayre may be sent.

LEt *E R* be the foot of the Lampe, which must haue a hollow pan of glasse or white tin, to containe the oyle in, and whereon to put foure cotton lights, which may be made to swim by passing the wyer wherein they are fastened, through foure small pieces of corke. Now there must be a vessell of brasse or tyn to bee borne ouer the lights with foure little pillars: you may make this vessell to seeme to outward appearance, like a Crowne: this vessell is noted with the letters *A B C, I*, a pipe that reacheth from the top of the vessell almost unto the bottome. This pipe must be made flat on one side, & halfe round on the other, and unto the top thereof, must bee sodered a round phillet of brasse, as *M*, the bottome of this phillet must couer the top of the pipe noted *I*: also it must hang ouer as much on the flat side of the pipe. Then let there bee made the image of a Cocke, which must be hollow, and under whose belly there must come

come a pipe with a bottome ſodered on it: this pipe muſt be turned to ſit euen with the phillet *M*, ſo that neither ayer nor water may come betweene their ioynts: make then a ſmall hole in the bottome of the phillet that is ſodered on the pipe directly ouer the hole of the ſaid pipe, *I*, alſo ſuch another hole make in the bottome of the pipe that comes from the belly of the rocke, ſo that it may anſwer unto the aforeſaid hole in the bottome of the phillet *M*, then turne the cock to the other ſide, and with a double bit make a hole both thorow the ſide of *M*, & alſo thorow one ſide of the pipe that comes from the cocks belly. Laſtly, you may make ſome hole whereat you may pull water into the veſſell, and to be ſtopped up and it's done. But obſerve this, that the pipe muſt firſt be fitted, and afterwards ſodered into the veſſell, ſo as the veſſell may give no vent but at the aboue mentioned holes in the ſaid pipes. The larger you make this veſſell towards A, G, T, the more ſtrange it will appeare in its effects, ſo the lights be proportionable. Fill the veſſell halfe full of water, and ſet the lights on fire underneath it, and after a ſhort time, if you turne the holes that are on the ſides of the pipes, that they may anſwer one another: then the water being by little and little conuerted into ayre by the heate of the lights that are underneath, will breath forth at the mouth of the Cocke; but if you turne the mouth of the Cocke the other way, that the holes at the bottome of the pipes may anſwer each to other, then there being no vent for the ayre to breath out at, it will preſſe the water, and force it to aſcend the pipe *I*, and iſſue out where the ayre breathed before. This is a thing may moue great admiration in the unskilfull, and ſuch as underſtand it not. Other devices and thoſe more ſtrange in their effects, may

be contrived from hence.

Amongst all the experiments pneumaticall, there is none more excellent than this of the Weather-glasse: wherefore I have laboured to describe the making thereof as plainly as it possibly might be.

What the Weather-glasse is.

A Weather-glasse is a structure of, at the least, 2 glasses, sometimes of three, foure, or more, as occasion serveth, inclosing a quantity of water, and a portion of ayre proportionable, by whose condensation or rarifaction the included water is subiect unto a continuall motion, either upward or downward; by which motion of the water is commonly foreshewn the state, change, and alteration of the weather. For I speake no more than what mine experience hath made me bold to affirm; you may (the time of the yeare, and the following observations understandingly considered) be able certainly to foretell the alteration or uncertainty of the weather a good many houres before it come to passe.

Of the severall sorts and fashions of Weather-glasses.

THere are divers severall fashions of Weather-glasses, but principally two:

1 The circular glasse.

2 The Perpendicular glasse: the Perpendiculars are either single double, or treble.

The single Perpendiculars are of two sorts, either fixt or moveable:

The

The fixt are of contrary qualities; either ſuch whoſe included water doth move upward with cold, and downward with heat, or elſe upward with heat, and downward with cold.

In the double and treble Perdendiculars, as the water aſcendeth in one, it deſcendeth as much or more in the other.

In the moveable Perpendicular the glaſſe being artificially hanged, moveth up and downe with the water.

How to make the water.

I Moſt confeſſe, that any water that is not ſubiect unto putrifaction, or freezing, would ſerve the turne, but Art hath taught to make ſuch a water as may bee both an ornament to the worke, and alſo delectable to the eye.

Take two ounces of Vardigreaſe in powder, and infuſe it ſo long in a pint of white wine vineger, untill it hath a very green colour, then poure out the vineger gently from the Vardigreaſe: take alſo a pint and a halfe of purifide Maw-dew, and put therein 6 ounces of Roman vitreoll in groſſe powder, let it ſtand till the vitreoll bee thorowly diſſolued; then mixe this with the former water, and ſtraine them thorow a cap paper, and put it into a cleane glaſſe well ſtopped, and it's ready for uſe.

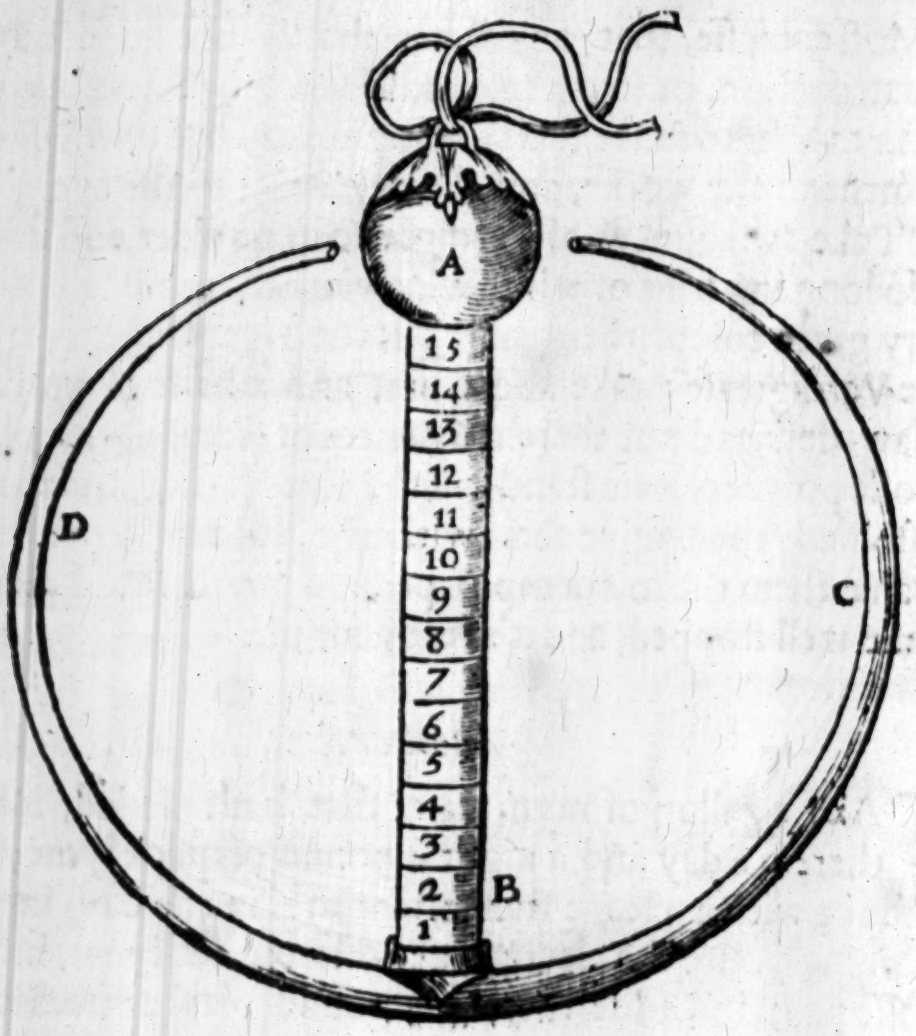
Another.

TAke a gallon of rayn-water that hath ſetled, infuſe therein a day and a night 4 pound of quick lyme; ſtir it about with a cleane ſtick oftentimes in the day; in the morning poure the cleere water off from the lyme, into a braſſe pan, and adde thereto 3 pound of ſal armoniack;

let it ſtand five or ſix houres, afterwards ſtir it about untill it be of a perfect blew colour, then ſtraine it thorow a browne paper rowled within a tunnell, and reſerve it for your uſe. This water is not ſo good for uſe as the former, for it leaveth a kinde of cloudy ſtaine upon the glaſſe when it falleth.

How to make the Circular glaſſe.

FIrſt, you muſt prepare two glaſſes, the faſhion wherof let be like unto the figures marked with the letters A, B, and C, D. The glaſſe C, D, is open at both the ends, al-



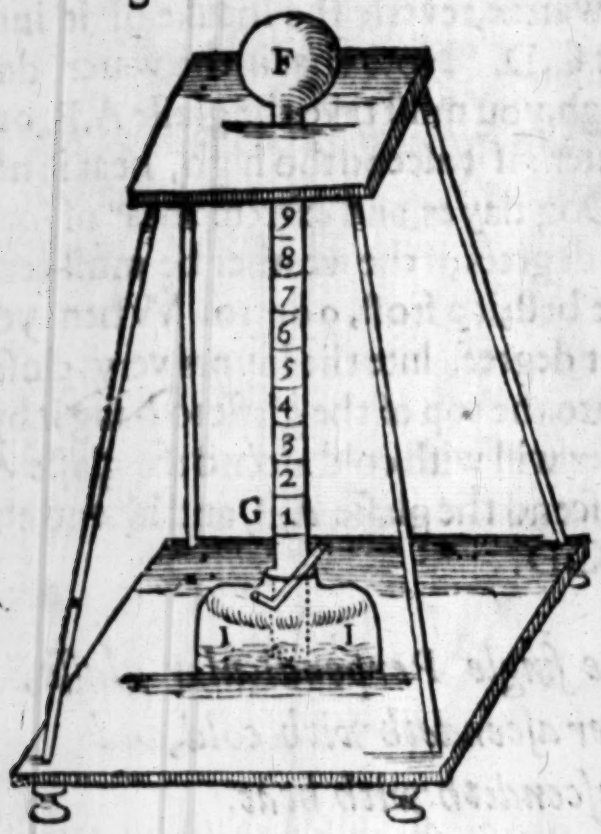
ſo

ſo in the middle there is a neck comming up of ſufficient wideneſſe to receive the ſhank end of the glaſſe marked with the letters A, B. Then fil the glaſſe C, D, a third part, with either of the waters, and divide the glaſſe into ſo many equall parts as you would have degrees; rarifie the aire in the head of the glaſſe A, B, by holding it to the fire, which being yet warme, reverſe the ſhanke of it into the necke of the glaſſe C, D. Note that if the water doe not aſcend high enough, you muſt take the glaſſe A, B, out againe, and heat it hotter: if it aſcend too high, heat it not ſo hot. If it be in the Dog-dayes, and extreme heat of ſummer, 1 and 2 are good degrees; if the weather be moſt temperat, then 3 and 4 are beſt; if a froſt, 9 or 10. When you have hit an indifferent degree, lute the ioynts very cloſe, and faſten a ribben unto the top of the glaſſe to hang it by. In this glaſſe the water will with cold aſcend the glaſſe A, B, with heat it will deſcend the glaſſe A, B, and aſcend the hornes of the glaſſe, C, D.

How to make the ſingle Perpendicular glaſſe, whoſe water aſcendeth with cold, and deſcendeth with heat.

PRepare two glaſſes after the faſhion of theſe figures underſet, E, G, I, I. Alwaies chuſe thoſe upper glaſſes that have the leaſt heads, els they will draw the water too faſt and preſſe it too low: alſo let not the ſhanke of the glaſſe be too wide: it is no matter to be curious in chuſing the lower glaſſe. Having provided both theſe glaſſes, make a frame for them about one inch longer than the ſhanke of the glaſſe, F, G, having a hole at the top to put the ſame thorow. There ought to be a great deale of care had in

making the frame so, that the foot therof may be of a greater compasse than the top, to the end that it may stand firme, and not be subiect to be turned downe, which will distemper the whole worke. After you have prouided the frame, proceed to the making of it after this manner. Put both the glasses into the frame, and then divide the shank of the glasse F, G, into so many equall parts as you would haue degrees; write figures upon paper, and paste them on, (with gumme tragagant dissolved in faire water;) then fill the bottom glasse 2 thirds with the water, & rarifie the ayre in the glasse, F, G, so often untill you have hit such a degree as is most fitting for the temper of the weather, put in a little crooked hollow cane for the ayre to passe in and out at, but let it not touch the water: then stop it about the ioynts of the glasse with good cement, that nothing may come out. Make an artificiall rocke about it, with pieces of cork dipt in glew, and rowled in this following powder, and it is done.



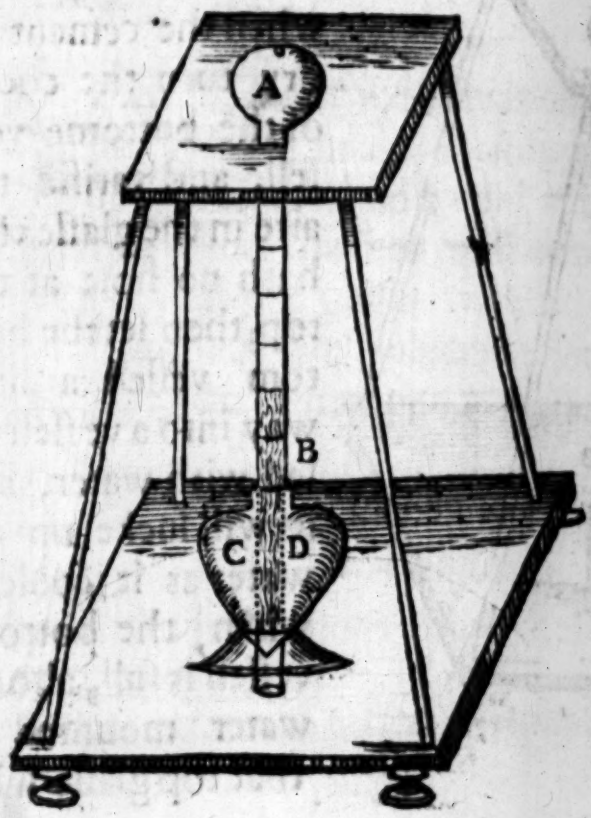
The powder for the rocke.

Take mother of Pearle a pound, small red Corall di. pound,

pound, Antimony crude 4 ounces, and make a groſſe powder of them.

To make the ſingle perpendicular glaſſe, aſcending with heat, and deſcending with cold.

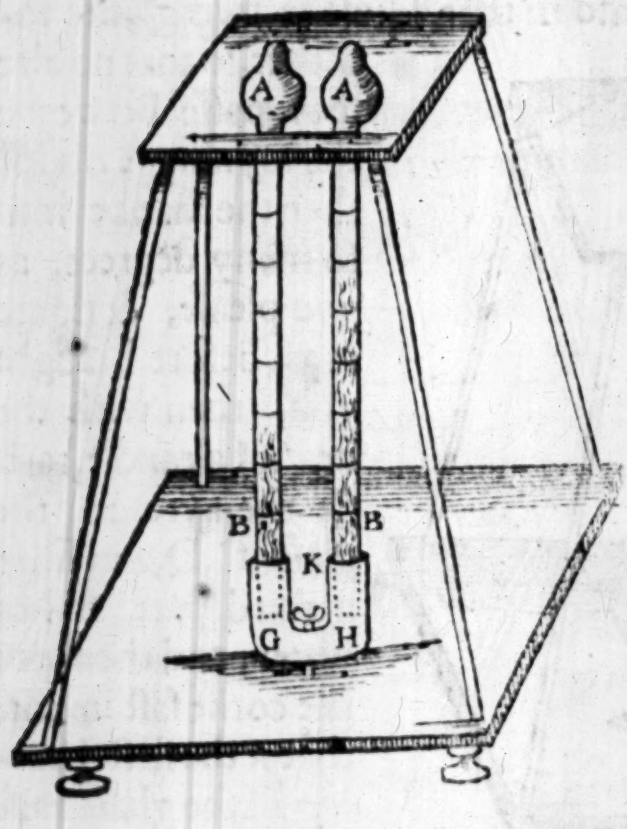
PRepare two glaſſes after the faſhion of the figure A, B, and C, D: let the glaſſe A, B, have a ſmall pinhole at or about the top of al, and let the glaſſe C, D, have beſides the hole at the top, another hole at the bottome with a ſhort pipe. Provide ſuch a frame for this as you did before for the other; then put the glaſſes into it, faſten the bottome glaſſe to the bottom of the frame, having a hole at the bottome, thorow which the pipe of the glaſſe C, D, may paſſe, fit a cork unto it: then lute the two glaſſes together, ſo that no aire may paſſe betweene the ioyning; divide then the ſhanke into ſo many degrees, as you pleaſe, & figure it as before I taught you, then with the heat of a candle, rarifie the ayre in the glaſſe, C, D, and fill it a third part full of water, and then put the corke faſt in: note that if the firſt heating of the glaſſe raiſe not the water unto your



your content, you muſt repeat it over and over, untill it do: when it is ſufficient, then ſtop the cork in very firme, that no water may come out, and it is made.

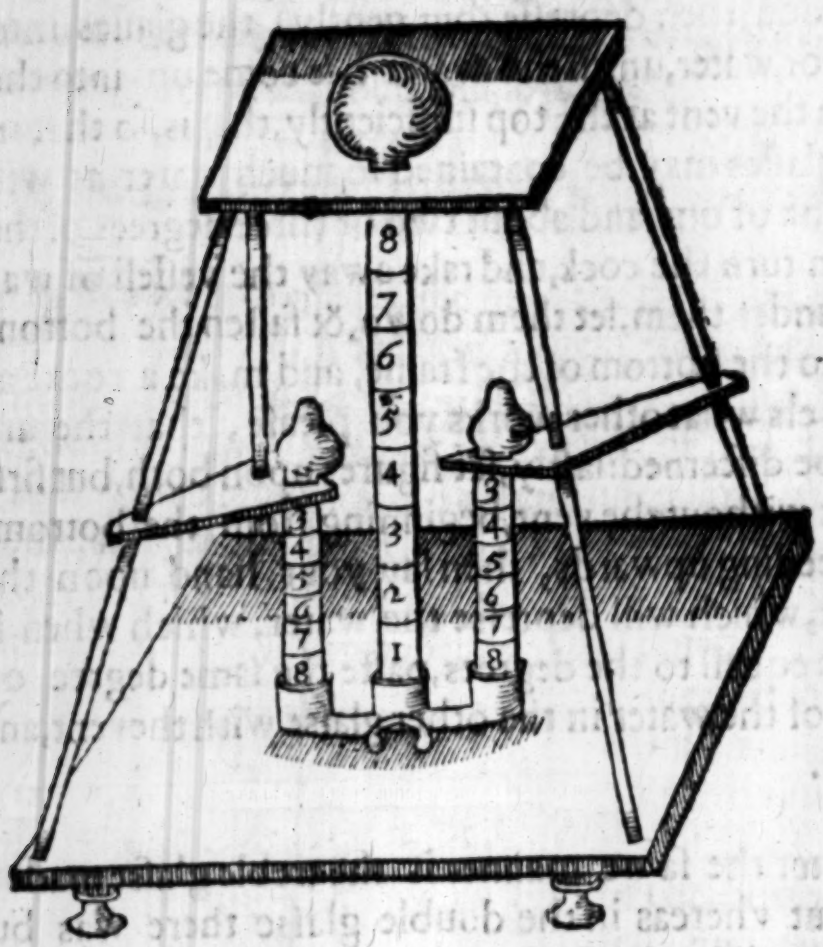
How to make the double perpendicular glaſſe.

PRepare two glaſſes like unto the figure marked with the letters A, B, the one of them muſt have a ſmall hole in or about the head thereof. Prepare likewiſe for the bottome a veſſell of the faſhion of the figure, G, H, having two mouthes, at each end one; alſo a cock in the middle, as K, divide then the ſhank of the glaſſe without the hole in the top, into equal parts, & ſet figures upon it: next lute thẽ both faſt into the necks of the bottom veſſel. (But firſt remember to put them in a frame:) when the cement is dry turn the cocke of the bottome veſſell, and rarifie the aire in the glaſſe that hath no hole at the top; then ſet the bottom veſſell a little way into a veſſell filled with water, and it will ſucke up the water as it cooleth, when the bottome veſſell is full, alſo the water mounted in that top glaſſe without



not a vent,up to a fitting degree;(the temper of the weather regarded)then depreſſe (but gently) the glaſſes into the veſſell of water,untill the water bee come up into the glaſſe with the vent at the top ſufficiently,that is,ſo that in both the glaſſes may be contained ſo much water as will fill the ſhank of one,and about two or three degrees of the other;then turn the cock,and take away the veſſell of water from under them,let them down,& faſten the bottom veſſell unto the bottom of the frame, and make a rocke about it,or els whatother works you pleaſe, that the art may not be diſcerned:laſtly,ſet figures upon both,but firſt upon that without the vent,beginning from the bottom, and proceeding upwards, then lay your hand upon the head of it,which will depreſſe the water, which when it commeth equall to the degrees,paſte the ſame degree on the place of the water in the other glaſſe with thevent,and it is done.

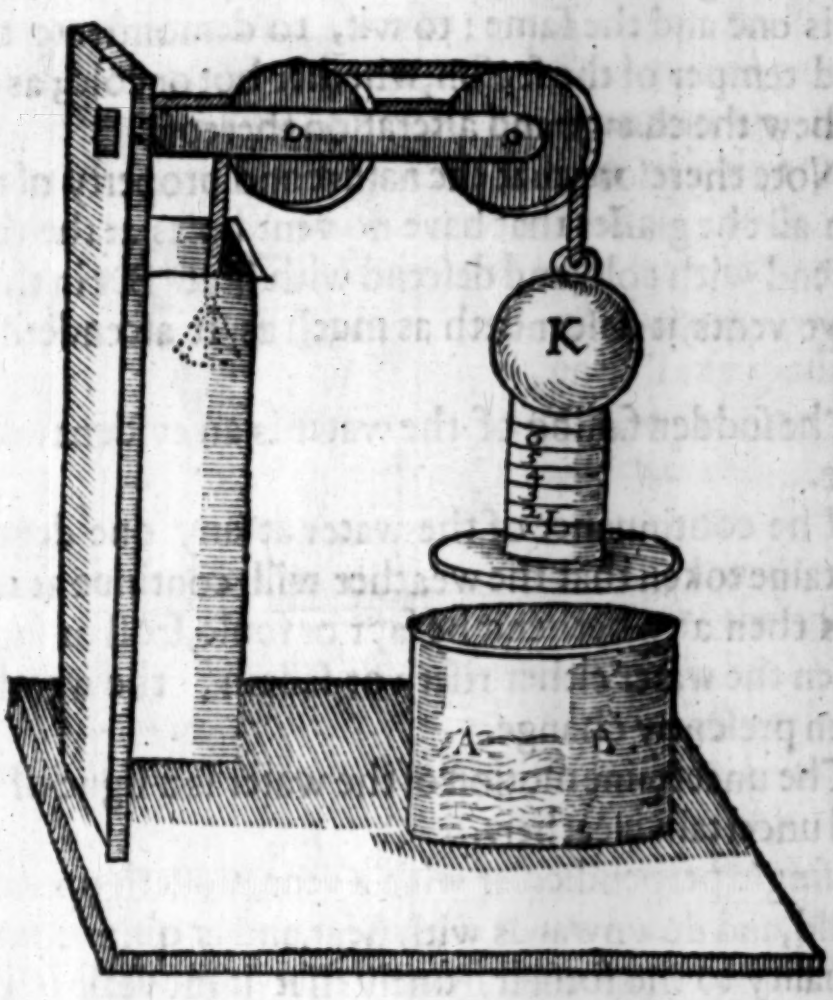
AFter the ſame manner is the treble glaſſemade: but whereas in the double glaſſe there was but one glaſſe that had a vent at the top, there is two in this,both whoſe ſhankes muſt containe the iuſt quantity of water that the glaſſe without the vent will containe. If you doe well obſerve the forme of the ſubſequent fignre,you cannot goe amiſſe.



How to make the moveable perpendicular glasse.

FIrst prepare the glasse A, B, fill it almost top full of water, provide also the glasse K, L, having a loope at the top of it: divide it into so many equal parts as you would have degrees, and on the mouth thereof fasten a thinne board, that will easily slip in and out of the bottom glasse, make

make then a weight of lead or braſſe ſomewhat heavier than both the glaſſe and board faſtned thereto; and then tie a little rope to the loope of the glaſſe A, B, and the weight at the other end thereof. Rarifie the aire contained in the glaſſe L, and reverſe it into the glaſſe A, B, filled



with water, and hang the plummet over two little pulleys faſtned in a frame made for the purpoſe, and as the glaſſe K, L, cooleth, the water will aſcend the ſame, and ſo by the change of the outward both the glaſſe & water will moue accordingly.

Of the use of all the severall sorts of weather glasses.

ALbeit the forms of weather glasses are divers, according to the fancy of the Artist, yet the use of all is one and the same: to wit, to demonstrate the state, and temper of the season, whether hot or cold; as also foreshew the change and alteration thereof.

1 Note therefore, that the nature and property of the water in all the glasses that have no vent holes at the top, is, to ascend with cold, and descend with heat. But in them that have vents, it descendeth as much as it ascendeth in these.

2 The sudden falling of the water is an evident token of rayne.

3 The continuance of the water at any one degree, is a certaine token that the weather will continue at that stay it is then at, whether it be fayr or foule, frost or snow. But when the water either riseth or falleth, the weather will then presently change.

4 The uncertaine motion of the water is a signe of fickle, and uncertain weather.

The single perpendicular with a vent, moveth upwards with cold, and downwards with heat, and is quite contrary in quality to the former, onely that it moveth uncertainely in fickle and uncertain weather, and keepeth a constant place in stayed weather.

These rules are all certaine and true: now you may according to your own observation frame other rules, whereby you may foretell the change of the weather, the water being at any one degree whatsoever.

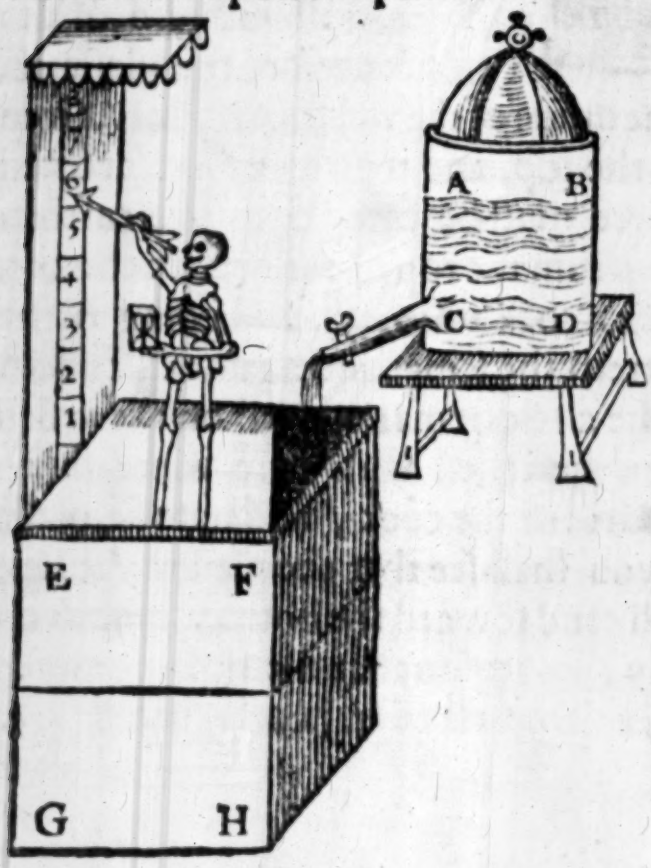
A Water-clock, or a Glaſſe ſhewing the houre of the day.

LEt there be provided a deepveſſel of earth, orany thing elſe, that will hold water, as A. B, C, D, provide alſo a glaſſe made after the faſhiõ of the figure marked with the letters K, G, G. It muſt be open at the bottome, and have alſo a ſmall hole at the top, thorow which if you can but put the point of a needle, it is ſufficient. This glaſſe muſt not be ſo long as the veſſell is deep, by about two inches. Then take a juſt meaſure of the length of the glaſſe K, G, G, and ſet it on the inſide of the veſſell A, B, C, D, from the bottom towards the top, and then make a raſe round about the veſſell; there muſt be fitted unto this earthen veſſell, a pipe reaching from the top of the outſide thereof, (where there muſt bee a cock unto it) and going to the bottom, where it entreth the ſame, and againe extendeth it ſelfe almoſt unto the circle or marke raſed on the veſſell A, B, C, D. Fill then the veſſell with faire water up to the raſe, or circle, and turne the cock, and put the glaſſe into the water, and you ſhall ſee that the glaſſe by reaſon of its heavineſſe, will tend toward the bottom of the veſſell, but very ſlowly, by reaſon that the ayre contained therein hath ſo ſmall a vent: turne an houre-glaſſe, and at

the end of each houre make a mark upon the glaſſe equal with the water, and it is done. When the glaſſe is quite ſunke to the bottom of the water, turne the cocke, and with one blaſt of your mouth at the pipe, it will aſcend againe.

Another faſhioned one.

PRepare a veſſell, as A, B, C, D, having a very ſmall cock unto it, whoſe paſſage ought to be ſo ſmall, as that the water might iſſue out but by drops. Prepare likewiſe a veſſell, as E, F, G, H, having at one end of it a piller of a foot and a halfe, or two foot high: let there be fitted unto this veſſell a board, ſo that it may freely without ſtay, ſlip up and downe: towards one ſide of this board, there muſt be a good big hole, which muſt be placed under the cock of the other veſſell. Then faſten unto the top of this board, the image of Time or Death, and pointing with a dart upon the piller aforeſaid: turne then an houre glaſſe, and at the end of every houre, make a figure on the place of the piller that the image with his dart pointeth at, & it is made. For note, the dropping of the water out of the cock thorow the hole of the board whereon the image ſtandeth cauſeth the ſame to aſcend by litle & litle. Mark the figures.

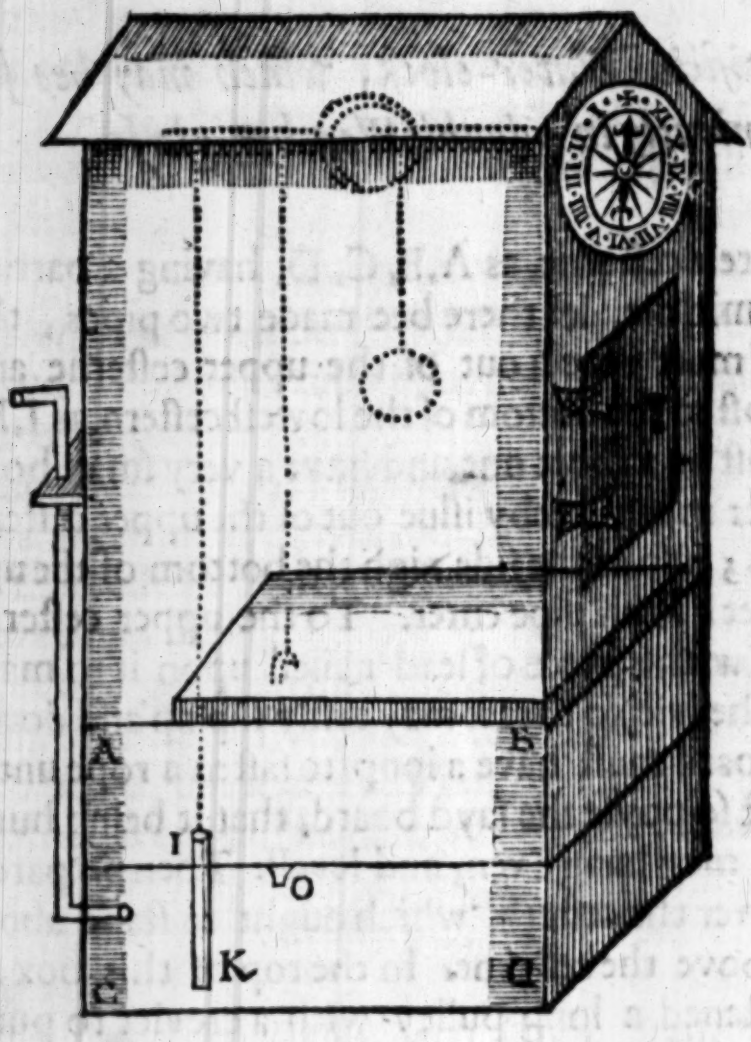


Ano-

Another artificiall Water-clock, which may bee ſet conveniently in a double Weather glaſſe.

FIrſt prepare a ceſterne, as A, B, C, D, having a partition in the middle, let there bee made two pipes, the one whereof muſt reach out of the upper ceſterne and deſcend almoſt to the bottom of the loweſt ceſtern, as I, K; the other muſt be a ſhort one, and have a very ſmall hole, that the water may thereby iſſue out of the upper ceſtern but by drops; alſo at the ſide nigh the bottom of the upper ceſtern, let a ſmall pipe enter. To the upper ceſterne fit a board, (with a peece of lead nailed upon it to make it ſomewhat heavie) ſo that it may eaſily ſlip up and down in it; this board muſt have a loop to faſten a rope unto, and you muſt ſo poyſe the ſayd board, that it being hung up by a line, may hang even, and levell. Then prepare a box to put over the ceſtern, which ought to ſtand about ſixe inches above the ceſterne. In the top of this box let there bee faſtened a long pulley with a crevice to put a ſmall rope over; in this crevice it were fitting to faſten ſmall pins, to the end that the rope might turne the ſayd wheele as the water falleth from under the board: let the ſpindle of this pulley come out at one ſide of the boxe whereon there is a Dyall drawne, containing ſo many houres as you would have it go for: unto this end of the ſpindle let there be fitted a needle, or director, to ſhew the houre; then put a ſmall cord over the pulley in the box, faſten one end thereof to the loop of the board, and at the other end let there be tyed a waight not quite ſo heavie as the board, then fill the upper ceſterne with water, and

the

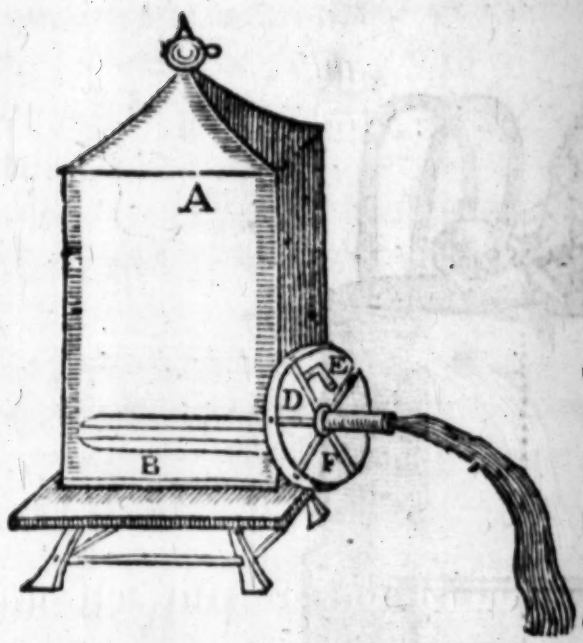


the board will presse it out into the lower vessell, at the pipe O, drop by drop, and as the board sinketh lower, it will by meanes of the rope upon the pully, turn the index fastned ũto the spindle of the pulley about the Dyall; you may set it by an houre-glasse or Watch: when it is quite downe, if you doe with your mouth blow into the pipe at the side of the cestern, the water will all amount up againe into the upper cestern.

A wheele which being turned about, it casteth water out at the spindle.

LEt A, B, be a tub, having in the bottom a brasse barrell, with a hole open quite thorow one side of it: let D,

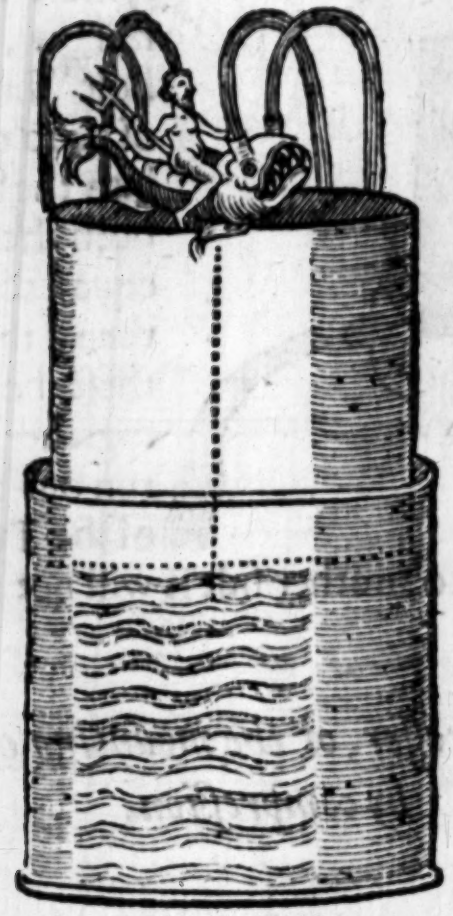
E,



E,F, be a wheele, whoſe ſpindle muſt bee alſo hollow, and have a hole thorow one ſide of it, ſo that being put into the hollow barrel, both the holes may be equall together. Note then, that ſo long as theſe holes are equall together, the water wil run out at the ſpindle of the Tub, but if you turne the wheele to another ſide it will not run.

A water-preſſer, or the mounting of water by compreſſion.

LEt there be provided a barrell of braſſe, of what length and wideneſſe you pleaſe, let it bee exactly ſmooth within, and very tight at bottom; unto this barrell fit a plug of wood leathered about, and let there be made divers ſmall holes quite thorow it, wherein faſten divers formes and ſhapes of birds, beaſts, or fiſhes, having very ſmall pinholes thorow them, for the water to ſpin out at: you ſhall doe well to make this plug very heauy, eyther by pouring molten lead into certaine holes made for the purpoſe, or elſe by faſtning ſome weight unto the top: fill the barrell with water, and put the plug into it, which lying ſo heauy upon the water,

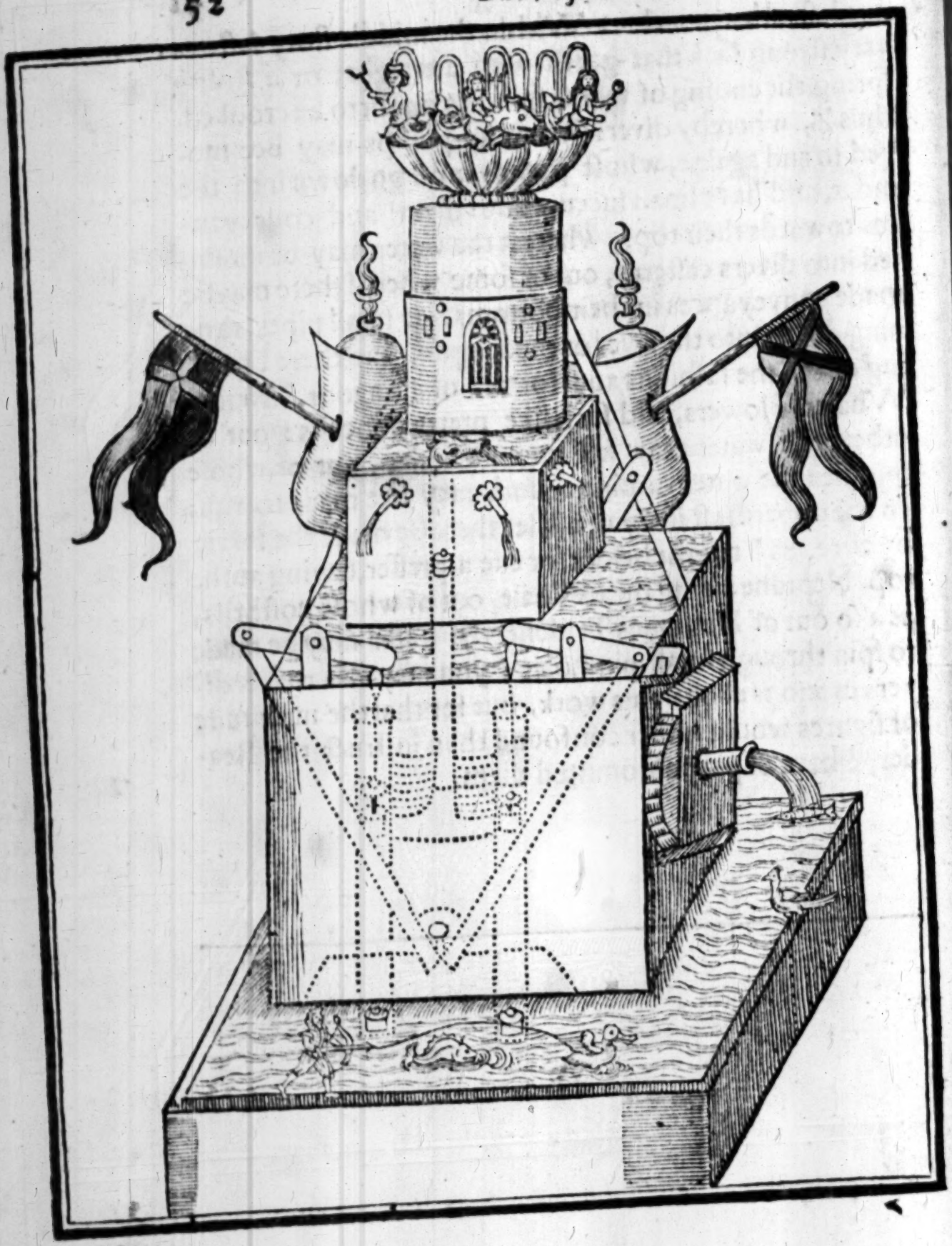


it will make it ſpin out at the pin-holes of the images placed thereupon.

How to compoſe a great or little peece of Water-worke.

FIrſt prepare a Table, whereupon erect a ſtrong frame, and round about the frame make a moat with a leaden ceſtern to be filled with water; let the leaden moat ſomewhat undermine as it were the frame, which ought to be built in three ſtories, one above another, and every one

one leſſer than another. Within the middle ſtory faſten a very ſtrong lack that goeth with a waight, or a ſtrong ſpring, the ending of whoſe ſpindles ought to be crooked, thus Z, whereby divers ſweeps for pumps may bee moved to and againe, whoſe pumps muſt go down into the moat, and have ſmall ſuccurs unto them, and convayances towards their tops, whereat the water may be mounted into divers ceſterns, out of ſome wherof there maybe made conveyances in their bottoms, by ſmall pipes running down into the river or moat again, and there breaking out in the faſhions and formes of Dragons, Swans, Whales, Flowers, and ſuch like pretty conceits: out of others the water may fall upon wheeles, out of whoſe ſpindles the water turning round, may bee made to run. In the uppermoſt ſtory of all, let there be made the forcer by ayre, as I taught before, or elſe a preſſer, having at the top, Neptune riding on a Whale, out of whoſe noſthrils, as alſo out of Neptunes Trident, the water may be made to ſpin through ſmall pin-holes; you may alſo make divers motions about this work, but for that the multitude of figures would rather confound than inſtruct the Reader, I have of purpoſe omitted them.



AN

Appendix unto the First Part.

CHAP. I.

YOu may remember I have told you formerly, that water one of the foure Elements, is a maſſie ſubtile ſubſtance; now every heauy thing wee know tendeth naturally downward, ſo that if it had a paſſage unto the middle or center of the earth, thither it would run, there it would abide. I taught you likewiſe, the uſe of the Crane pipe, which is called by ſome the Philoſophers Engine, whereby water may bee convayed from a Fountaine, notwithſtanding the Interpoſition of Hills and Mountaines: this conſidered, that the place unto which you would convey the water, lye ſomewhat lower than the Fountaine, which may eaſily be eſayed by divers inſtruments, principally the Geometrical Square: ſo the place may be viewed from the Fountaine, or both the place and the Fountaine may be viewed from

any Tower Church or Hill, that is betwixt both. The deſcription and uſe of which inſtrument, ſince it is both eaſie and common, it will bee needleſſe for mee to deſcribe.

This is the naturall courſe of water, but there is a ſecond kinde of conveyance of water, which we call artificiall, whereby by Engins artificially contrived, we either draw or force up water, to ſome higher place or places to bee thence conveyed unto any place deſired. Theſe Engines receive their motion divers wayes. Firſt, by the ſtreame of the ſame River, wherein they are placed. Secondly, by the Winde. Thirdly, by Horſes. Fourthly by a Crane-mill, and laſtly by divers Pumps, Forces, and ſuch like Inventions. You may remember likewiſe, that I have formerly told you, that no water worke can be compoſed without Succurs, Forcers, Clacks, either or every them, And now I will not inſiſt upon what I have formerly ſpoken, but referre you for that unto my former booke, and proceed to the deſcription of ſome things of more ſeruice and difficult compoſure. Firſt, I will deſcribe other Clacks, and Succurs, teach their divers application, and then I will deſcribe certaine Milles and Engines. Firſt, for mounting of water to be conveyed to remote places, for divers uſes, ſecondly for dreining of Medowes, thirdly, for quenching of fire in buildings, and laſtly, for recreation and delight.

CHAP. 2.

BY the letter A, is ſignifyed a Succur, made after the uſuall manner, ſaving that it hath an edge round about the bottom of it: which edge or brim hath divers little holes

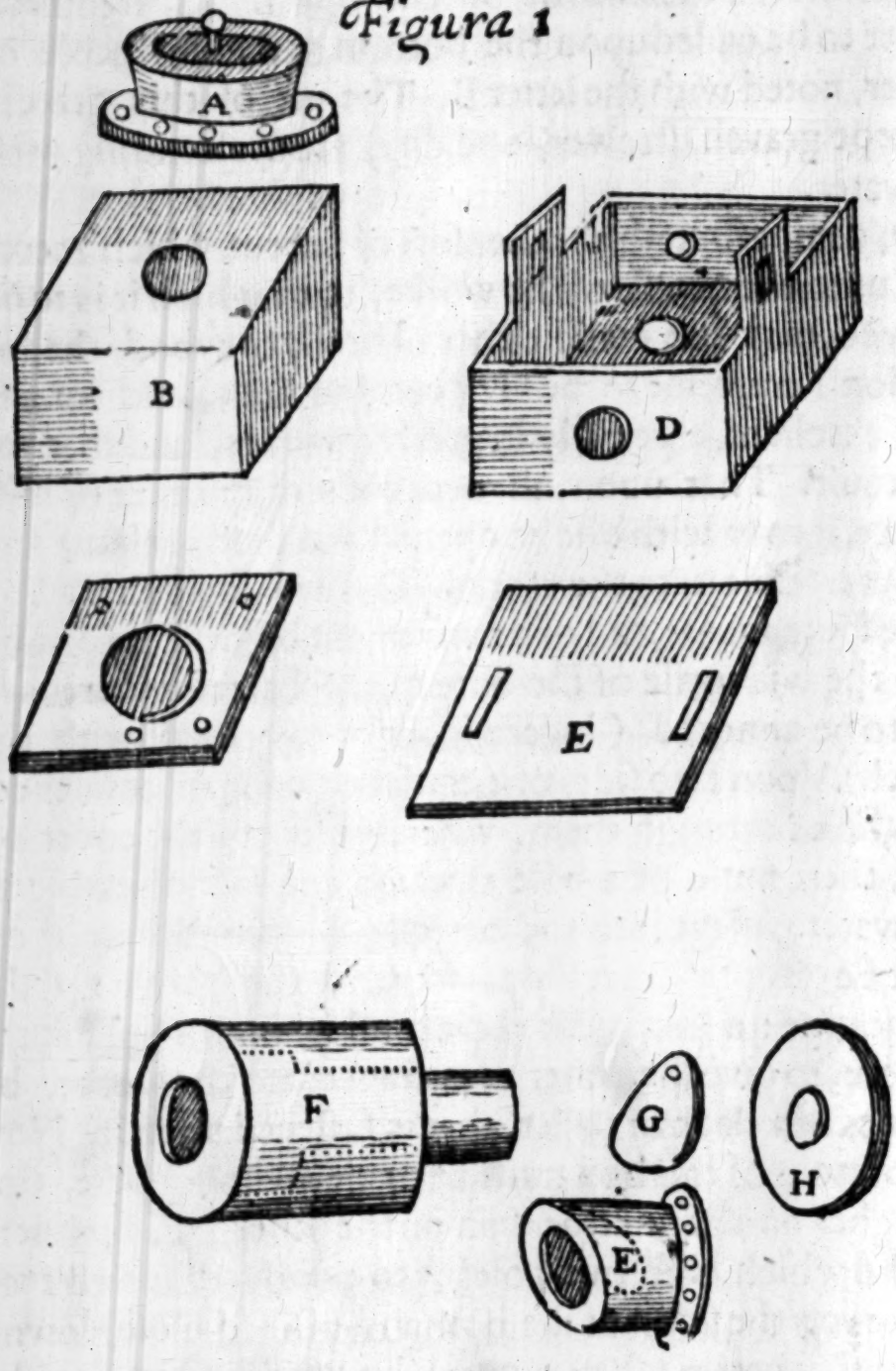
holes in it, whereby to naile it upon any part, where need requireth. B, signifieth a peece of Timber made square, and perforated to naile the Succur upon. C, signifieth a grate to be nailed upon the bottom of the said peece of timber, noted with the letter B. The use of this grate is to keepe gravell, strawes, and dirt, from ascending with the water.

D, demonstrateth another sort of Succur which according unto the Stresse of the worke, unto which it is to be applyed, may bee made either of brasse or wood, the Invention I conceiue to be very commodious, and for use most excellent, especially in greater workes, and that for this cause. That upon all occasions of disorder or mischance, it may with ease be opened and shut without any farther trouble unto the worke. D, I say signifieth a box made foure square, and of a convenient bignesse according unto the wideneſse of the bore of the barrell whereunto it is to be annexed (indeed it ought to bee cast with the barrel.) Vpon two sides of it, must be two small eminences with holes through them, whereby to pin the cover on fast; there must be a hole through one side of it, to give the water passage into the barrell: A second hole there must be on the other side, to send the water up the maine pipe: a third hole there must be in this boxe at the bottom, to give the water admittance into the worke, by meanes of a clack or pallet, that is fastened upon it. Now the bottom of this box must be made reclining wise, that is higher on the one side than on the other. E, signifieth the lid which hath two holes, to put over the two eminences on the sides of the box and pinned close downe. Note that you must put good liquered leather doubled betwixt the box and the lid, which serveth to keep it tight.

E,

F, ſignifieth a barrell of braſſe, made to skrew on any part with one end. H, ſignifieth a cover that is to bee

Figura 1



ſodered upon the other end, this cover muſt have a hole bored in it, to give the water ingreſſe into the worke. G, ſigni-

ſignifieth a clack or pallet to be faſtned upon the inſide of the cover H.

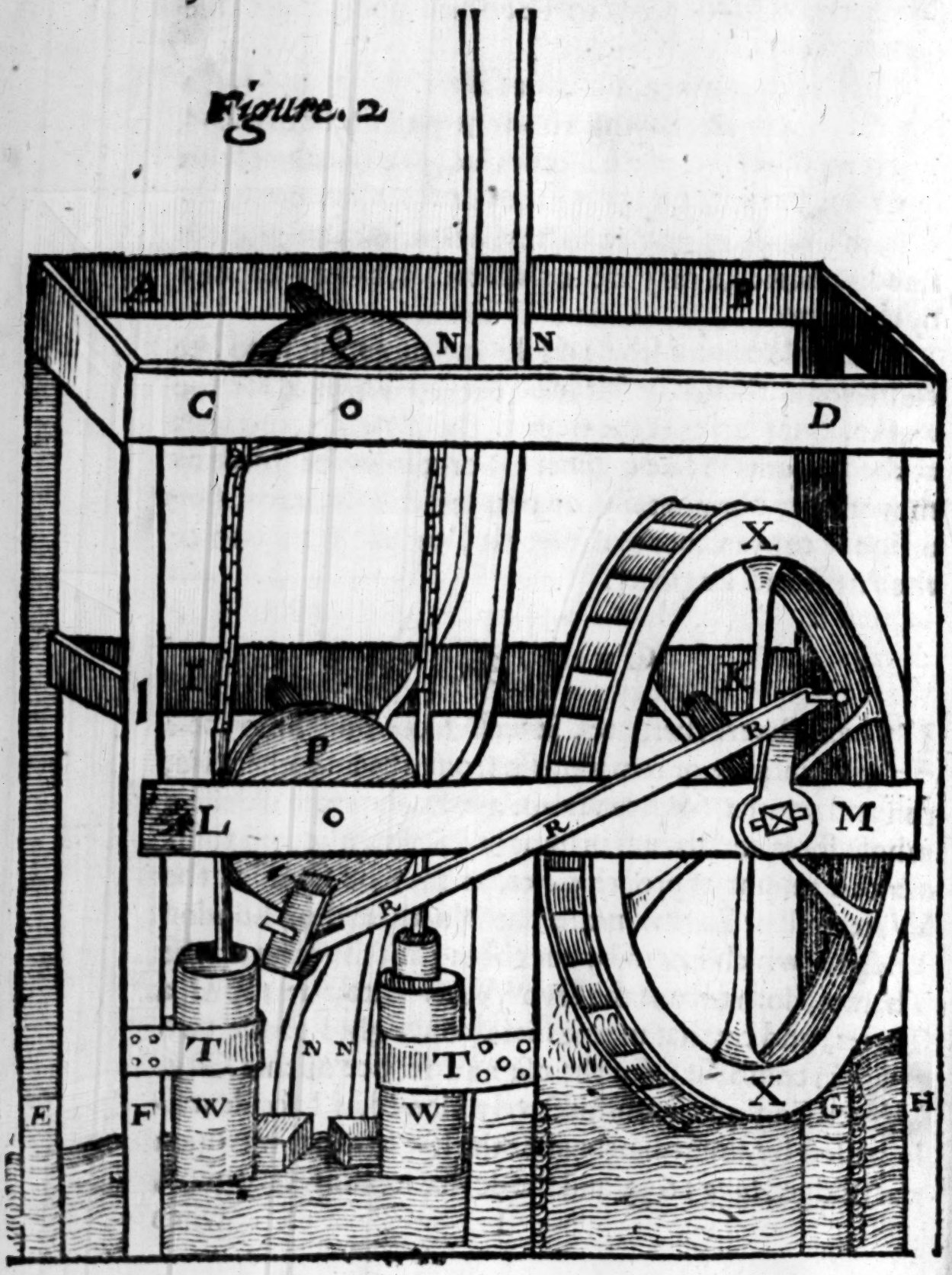
I ſignifieth another Succur or rather pallet, and it is a box made of braſſe, having a bottom with a hole in it, and over it muſt be reveted a pallet or clack; the bottom of this box muſt be made higher on the one ſide than on the other, ſo that being nayled to any perpendicular or erect ſtanding barrell, it may incline ſomewhat, as may appeare by the figure.

The application of theſe clacks and ſuccurs is ſo to bee contrived as they may ſuit with the convenience for the worke. Sometimes at the ſides of the barrels, ſometimes at the bottoms in like manner: Forces may be made to move either horizontally or perpendicularly, according unto the convenience of the worke, or the invention of the Artiſt and Engineer.

CHAP. 3.

DIvers Rivers there are, which according unto their propinquity or remoteneſſe from their mother Sea, run and returne (I meane ebbe and flow) more or leſſe; whoſe force and ſtream in ſome is of its own accord, ſufficient to mount its proper water, as may be ſeene at the Water mill or Engine neare the North end of London Bridge: which Engin by the ebbing and flowing of the Thames, doth mount the ſayd Water unto the top of a Turret, and by that meanes it is conveighed above two miles in compaſſe, for the uſe and ſervice of that City. Which Engin I circumſpectively viewed, as I accidentally paſſed by, immediately after the late fire that was upon the Bridge *Anno* 1633. and the device ſeeming very good,

Figure. 2



when I came home I drew a modell thereof, and have here presented it unto the view.

A, B, C, D, E, F, G, H, I, K, L, M, doe signifie a frame strongly made of Timber, X X, signifie the water wheele, the Gudgins of this wheele must be set to turne in strong brasse sockets, firmely set in the two middle beames of the Frame I, K, L, M. The ends of the said Gudgins, must be made to reach a good way over the beames, and they must be made square towards their ends, and have each a handle pinned fast on. Then in the middle beames I, K, L, M, must likewise be fastened another strong wheele, as P, which must have as it were a spoak, reaching out from it, upon the lower side. There must also be another halfe or 3. quarter wheele, as Q, placed directly above it, whose Diameters must be of one size or proportion: directly under the utmost edges of these wheeles must be firmely set two strong barrels of brasse or iron, which is of more durance as W, W, having each of them a succur cast with the barrels, these barrels must bee bound fast unto two posts of the frame, with two strong yron bands, as T T, to the end they may not stirre: unto each of these must be fitted a force well leathered, and in the tops of the forces must be set two pieces of wood, two foot long, and about two inches thicke, and to the tops of them must be linked two chaines of iron: which must be linked straight up to the two ends of an iron band, that must compasse the circumference of the uppermost wheele noted Q: a long and strong wooden barre must come over the handle of the maine wheele, and upon the spoake of the wheele P, this barre is noted with R R R. N, N, N, signifie the Pipes whereinto the water is forced. These pipes carry the water to the top of a Turret neare adjoyning

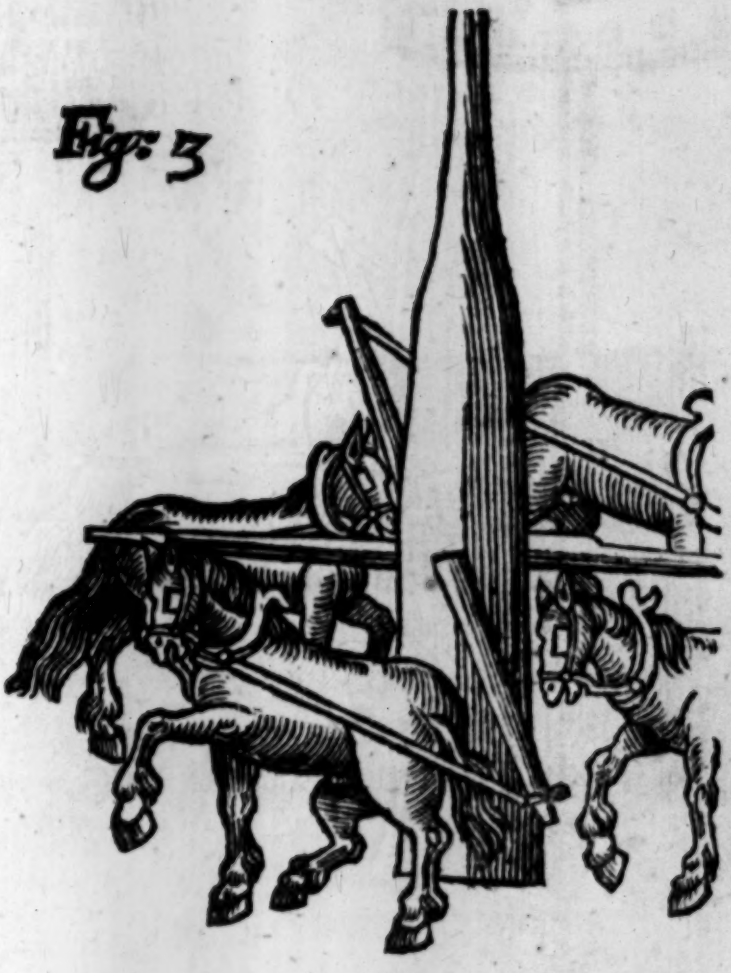
unto the Engin, and there being ſtrayned, thorow a cloſe wyer grate, it deſcendeth into the maine wooden pipe, which is layd along the ſtreets, and into it are grafted divers ſmaller pipes of lead, ſerving each of them to the uſe and ſervice of particular perſons.

CHAP. 4.

The Deſcription of a ſecond Engin for a Tyde-water.

THis Mill I have in part deſcribed in my former Booke, And therefore I ſhall not need to make repetition of that which I have there ſpoken. The Figure it ſelfe is plaine, and needeth little or no explication: nevertheleſſe, that I may give every one content, take thus much in brieſe. A A, B B, ſignifyeth the frame; G C, the water Wheele; D D D, two hollow poſts whereup the Water is driven; E E, the ceſtern wherin the water is driven up. F, one Wheele in the Wel; G, another wheele at the top of the poſts. The Water turning about the wheele C C, that turneth the wheele I I, the wheele I I, turneth the wheeles G, K, and F, and ſo by meanes of a chaine that is linked over the wheele G, and under the wheele F, the water in the Well by certaine leathers that are upon every 6. or 8. linke of the chaine, is borne up one of the barrels into the ceſterne E F, and thence it deſcendeth by M.

Fig. 3



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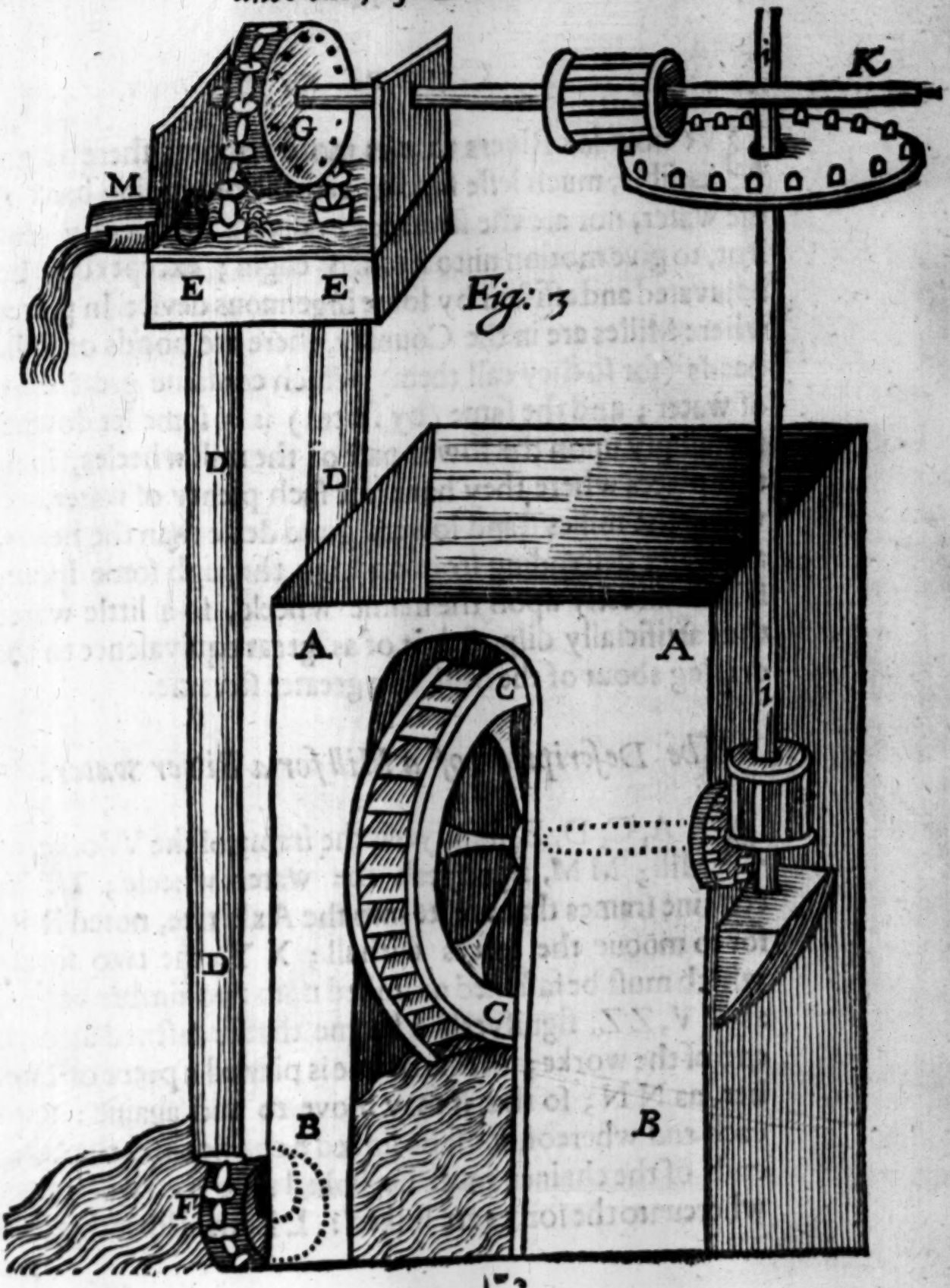


Fig: 3

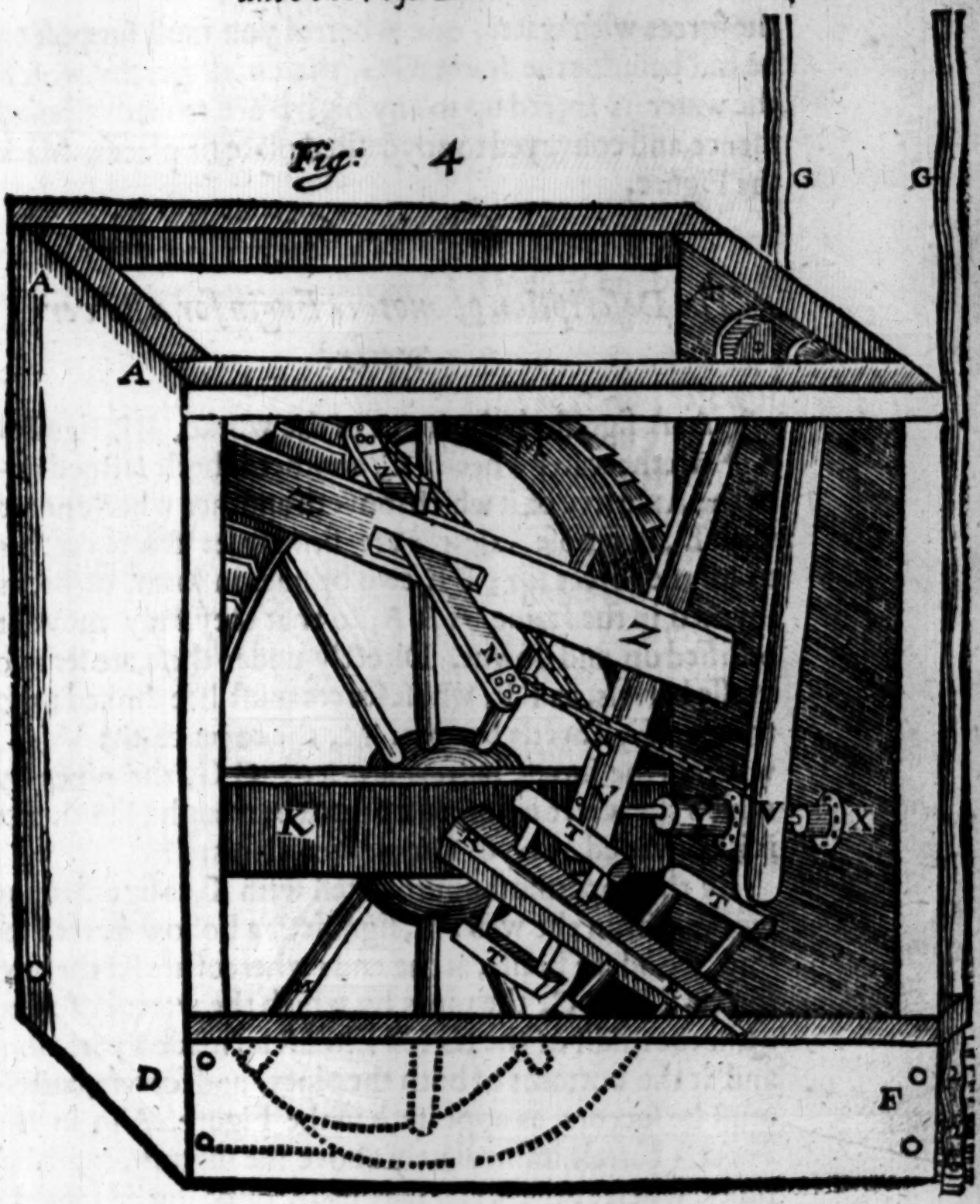
Chap. 5.

BVt now for Rivers that is more remote, there is no ſenſible, much leſſe forcible returne or regoing back of the water, nor are the ſtreames in divers ſufficiently violent, to give motion unto a mill or engin; except they be adjuvated and aſſiſted by ſome ingenuous device. In places where Milles are in the Country, there are ponds or mill-heads (for ſo they call them) which containe great ſtore of water; and the ſame (by ſluces) is in ſome let downe ſhelvingly upon the lower part of the mill wheeles, in other places where they have not ſuch plenty of water, and where the milles ſtand lower a good deale than the heads, the water deſcending from on high through ſome ſpout, falleth directly upon the maine wheele, ſo a little water thus artificially diſpoſed, is of as great equivalence to the driving about of the Mill, as a greater ſtreame.

The Deſcription of a Mill for a River water.

AA A, C, D, E, ſignifyeth the frame of the Worke, or Mill; M M, ſignifyeth the water wheele; T T T, certaine frames that are let into the Axle tree, noted R R, for to mooue the forces withall; X Y, the two forces which muſt be faſtened or linked unto two timber beams, as V V, Z Z, ſignifyeth a beame that is faſtned at each end of the worke; in this beame is pinned a peece of Timber, as N N; ſo that it may move to and againe: unto each end whereof, muſt be linked a chaine, and the other ends of the chaines muſt be linked unto the two beames whereunto the forces are linked: L L, the Pipes that feed the

Fig: 4



the forces with water, one whereof you muſt ſuppoſe to be hid behinde the frame G G, the two Pipes by which the water is forced up to any high place to bee diſpoſed thence, and conveyed to any deſired place or places. Mark the Figure.

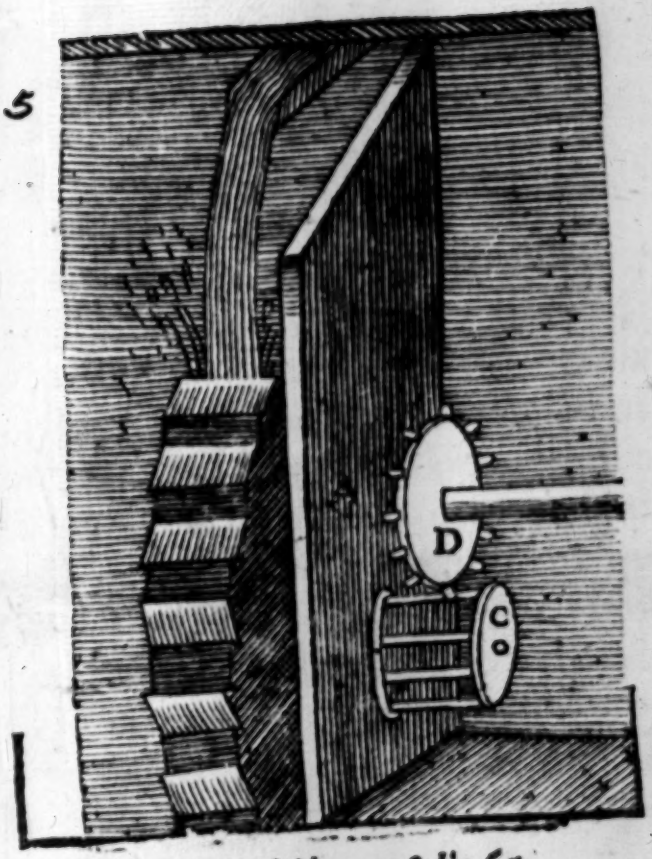
CHAP. 6.

The Deſcription of another Engin for a River water:

A A A ſignifieth the frame of the worke, B B, ſignifyeth the water wheele, C, another wheele faſtned unto the Axle tree of it which moveth another wheele noted with D, in whoſe Axle tree are firmely ſet divers catches to lift the forces up; E E, two beames in forme of beetls joynted in the frame A A A, ſo that they may move or be lifted up and downe. Directly under theſe, are ſet two braſſe barrels, as F F, whoſe forces muſt bee linked unto the aforeſayd beetls beames. M, the cover of the Well, wherein the forces barrels are ſet: G G, the pipes by which the water is forced up into the trough H H, thence it is conveyed at N, to ſome lower places.

By the uppermoſt figure noted with K, is ſignified the worke within the well; L, ſignifieth a hollow barrell of lead, wood, or braſſe, at the ends whereof are ſet the two forces F F, G G, the pipes by which the water is forced up in the midſt of the barrell L, muſt be made a partition, and at the bottoms of both the pipes, and forcers, barrels muſt be ſuccurs, as appeareth in the Figure. Alſo in the Forcers barrels immediately above the ſuccurs, muſt bee holes, whereat the water may paſſe, or be forced into the barrel L, and ſo up the pipes F F.

5



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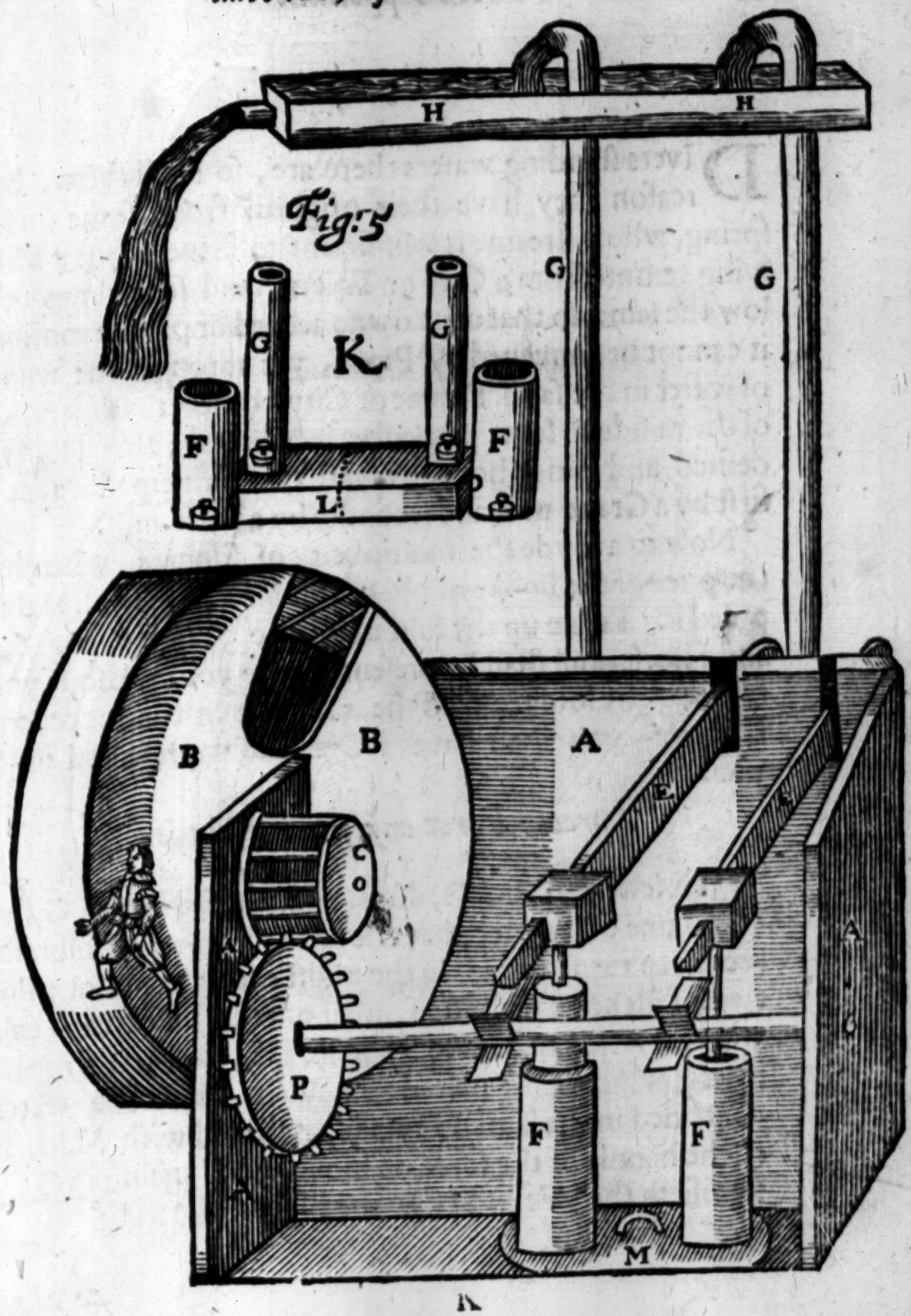


Fig: 5

Chap. 7.

Divers ſtanding waters there are, ſo I call them, by reaſon they have their originall from ſome ſmall ſpring, whoſe ſtreame is inſufficient to drive about a Mill lying remote from a City or Towne, and ſometimes below the ſame, ſo that of its owne accord or proper motion it cannot be conveyed by Pipes, yet through the want of water in the ſayd Towne or City, or for the ſatisfying of the minde of ſome particular inhabitant; this ſame is deſired, and it may bee conveyed two principall wayes; firſt by a Crane mill, and ſecondly by a horſe-mill.

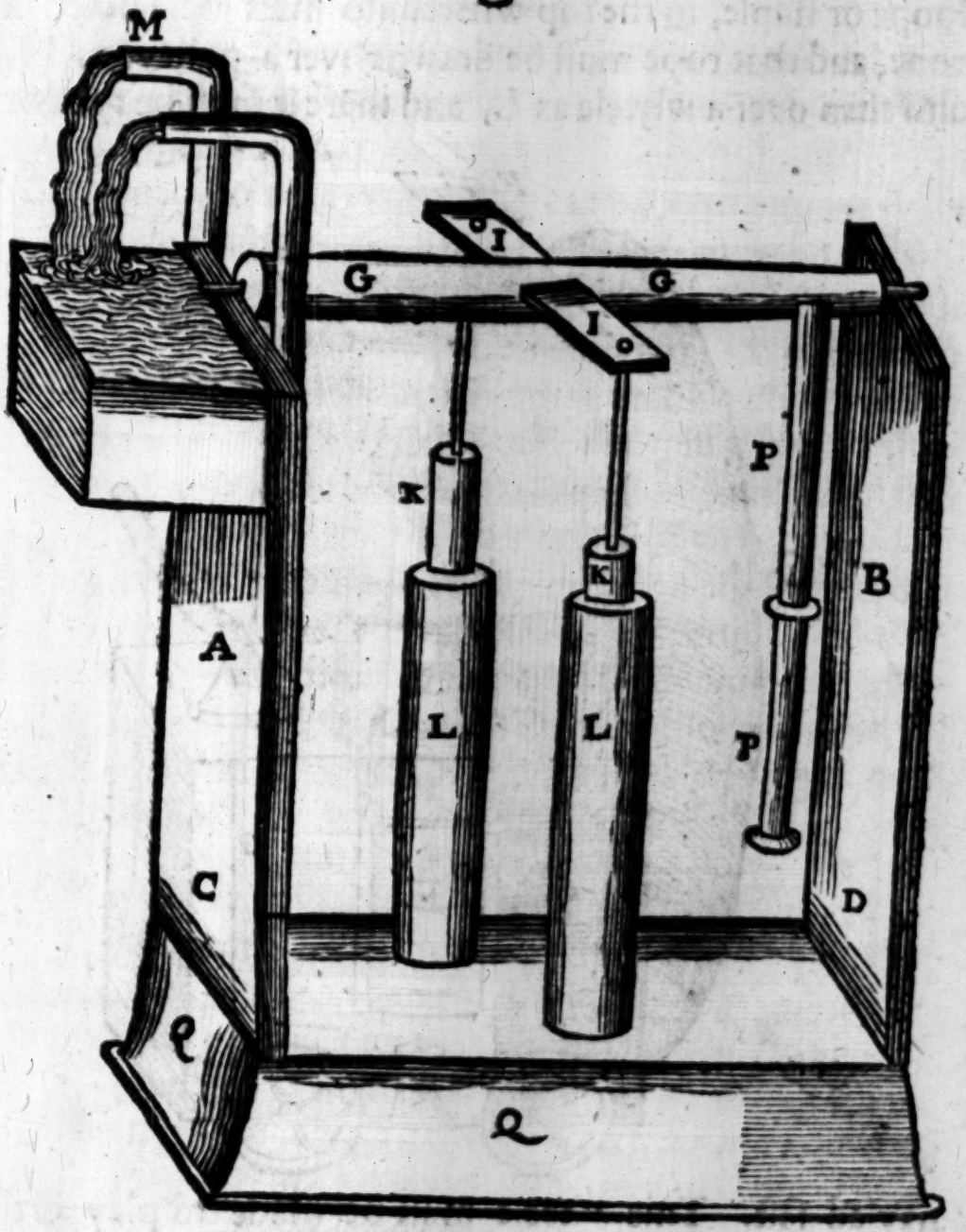
Now to avoyde the multiplicity of Figures, whereby the price of the booke might be doubled; I have thus diſpoſed it. Turne up the fold upon the 3. figure pag. 61. and a horſe-mill ſhall be preſented unto you. Alſo, if you turne up the fold from off the 5. figure in the precedent Chapter, you ſhall have a Crane mill preſented unto you.

A pretty Force eaſily to bee made.

THe letters A B C D, doe ſignifie the frame; G G, the beame or axletree that is let into the frame with braſſe ſockets to turne round. In the midſt of this beame or axletree *is faſtened a peece of Timber noted I I, unto each end* whereof is linked a force, as K K, L L, the barrels of the forces, which being placed in a Well Force the water conteined in the ſame up two pipes, noted with M M, P P, the handle of the force, to move to and again; Q Q Q, ſignifieth the Well. Marke the Figure following.

Another

Fig: 6

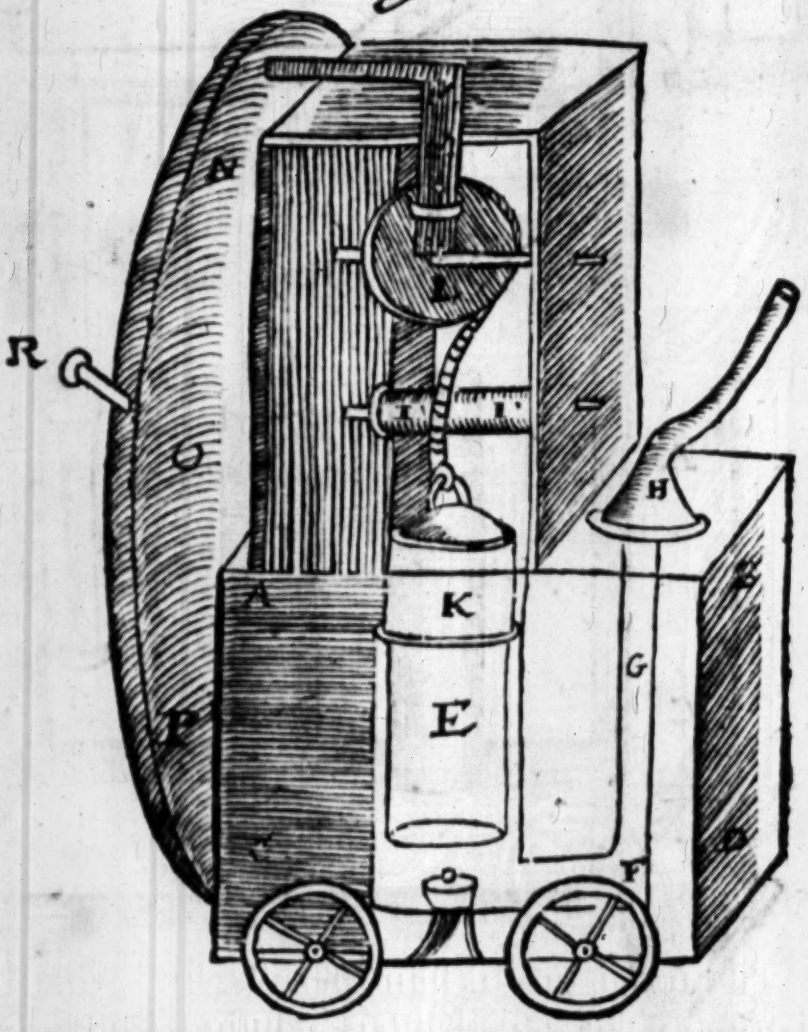


Another pretty Force.

A B, C, D, signifieth a Well, E, a barrell of brasse or wood fastned in the well, K, a force fitted unto it,

F G H, the pipe by which the water is forced up; the force must be very heavie, and must have a strong yron loope or staple, in the top whereunto must be fastned a rope, and that rope must be drawne over a pulley, as I I, and then over a wheele as L, and there it must be tyed or

Fig: 7



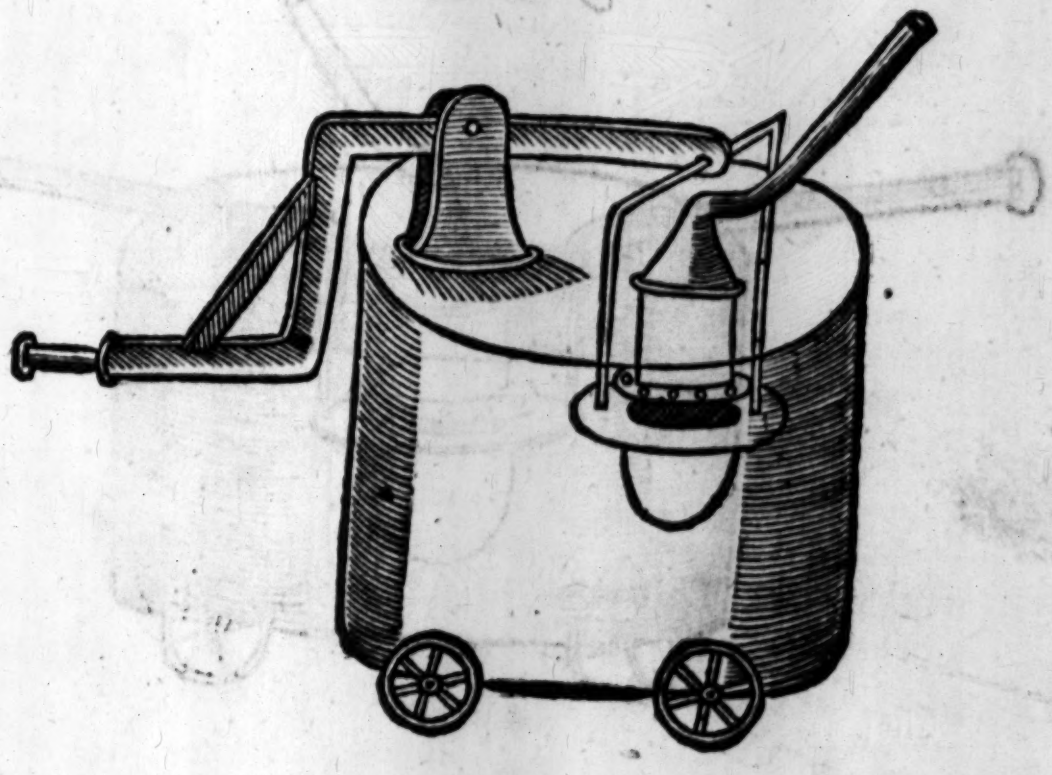
nayled fast. This wheele must be made to play in the work, and unto it must be nayled an iron rod noted with M M, the end whereof must passe thorow a hole made in the wheele N O P: R, signifieth the handle of the sayd wheele.

Chap. 8,

CHAP. 8.

HAving sufficiently spoken concerning Milles and Engins for mounting water for meere conveyance, thence we may derive divers squirts and petty Engins to bee drawne upon wheeles from place to place, for to quench fire among buildings; the use whereof hath been found very commodious & profitable in Cities and great Townes, this considered, that they have water at hand sufficient to feed them withall: for they doe by their violent casting the water up dead the fire, having new taken hold upon any out-side of a building. Also, they doe the

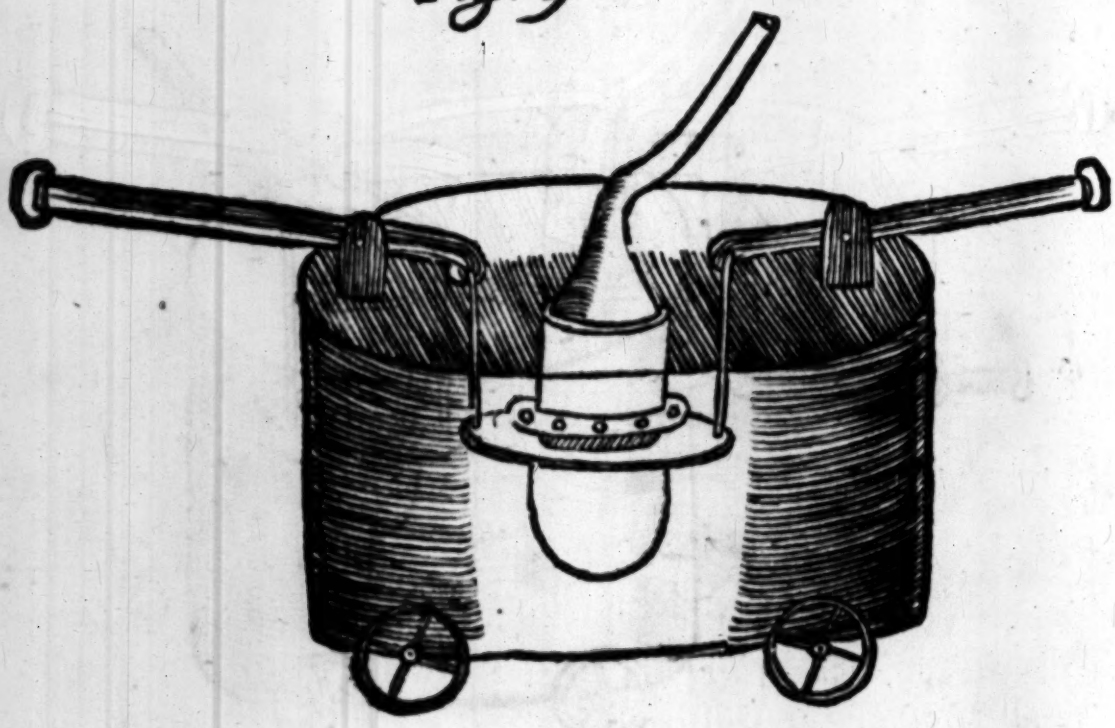
Fig: 8



ſame if the convenience of the place doe permit ſo to place the ſayd Engins, that the water ſquirted, may fall directly upon the eruption of the flame. Their deſcriptions follow, firſt ſuch as I have ſeene uſed, then ſuch as I conceive to be no leſſe uſefull than the former. They conſiſt for the moſt part of forces. One I have deſcribed in my former Booke; it remaineth onely, that I incloſe it in a caſe or ceſterne to put the water in, and to be drawne from place to place, as neceſſity requireth.

A ſecond Engin I have ſeene in uſe, not much unlike the former: The difference betwixt both, is onely this; the lower braſſe of this is poyſed with two ſweeps, and the other but with one.

Fig: 9



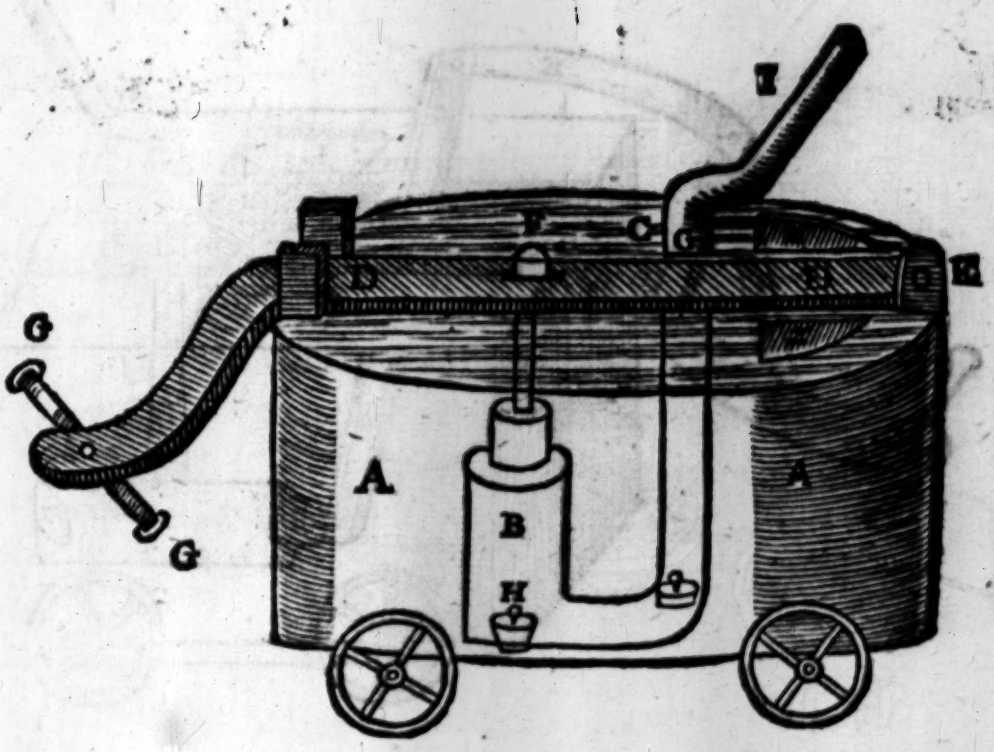
For uſe I account the other altogether as good as this, nay

nay rather the better of the two; becauſe that this, being wrought upon by two ſeverall perſons, they cannot alwayes keepe a juſt time one with the other in fetching their ſtroakes, but they will ſtrike ſooner ſometimes, and ſometimes later, the one than the other.

The Deſcription of a third Engin.

A A, ſignifieth a ceſtern, B, a barrell of yron or braſſe faſtened in the midſt of the ceſterne, with a force fitted unto it; this barrell muſt bee made to turne up out of the ceſterne at C, D D, a beame that lyeth a long the top of the ceſterne, and it is made with a joynt at E, to lift up and downe; in the middle of this beame there muſt be made a mortiſe hole, wherein the point muſt be joynted, as may be ſeene at F: G G, doe ſignifie two

Fig. 2



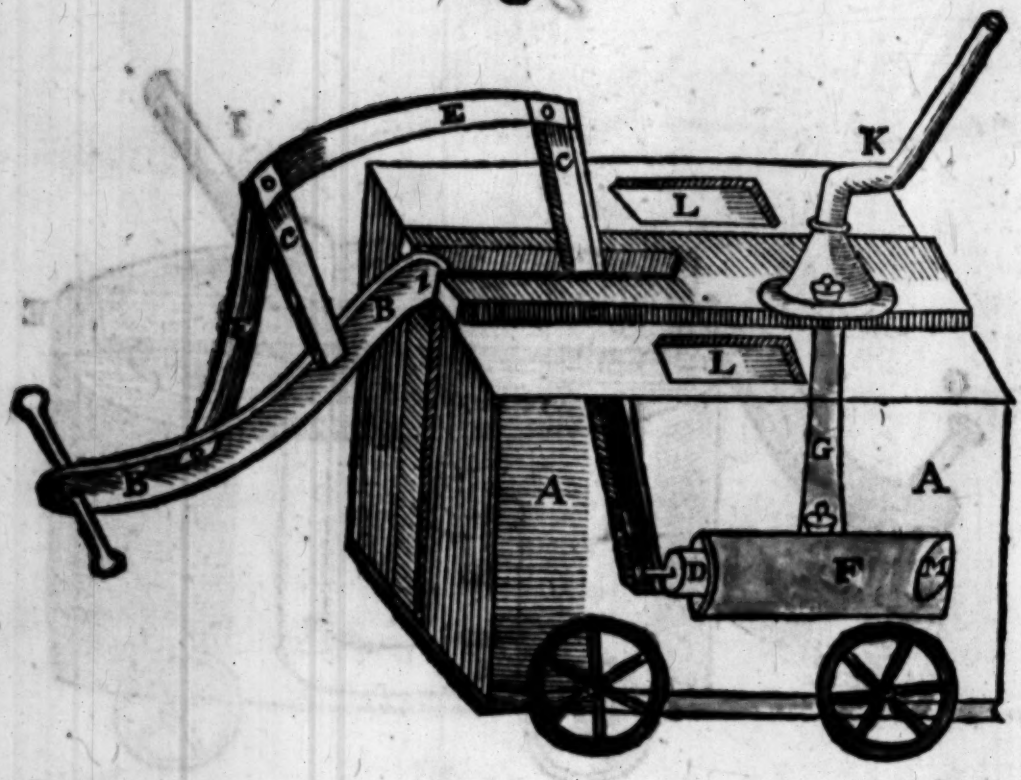
handles

handles whereby to liſt up the beame, which being liſted up, will with it draw the force up alſo, and ſo the water in the ceſterne, will come up into the barrell, at the Succur that is at the bottom of it noted H; now the beame falling downe, preſſeth the water violently out at the pipe I, at the top of the ceſtern: Z Z, two holes whereat the ceſtern muſt continually be ſupplyed with water.

The Deſcription of a fourth Engin.

A A, ſignifieth a ceſtern, B B, a beame that is joynted at I, C C, two pieces of timber faſtned in the aforeſayd beame, unto the lowermoſt end of one of the peeces noted C, the force is linked and it is noted with the letter D, within the ceſterne E E, a barre of iron

Fig. 11.



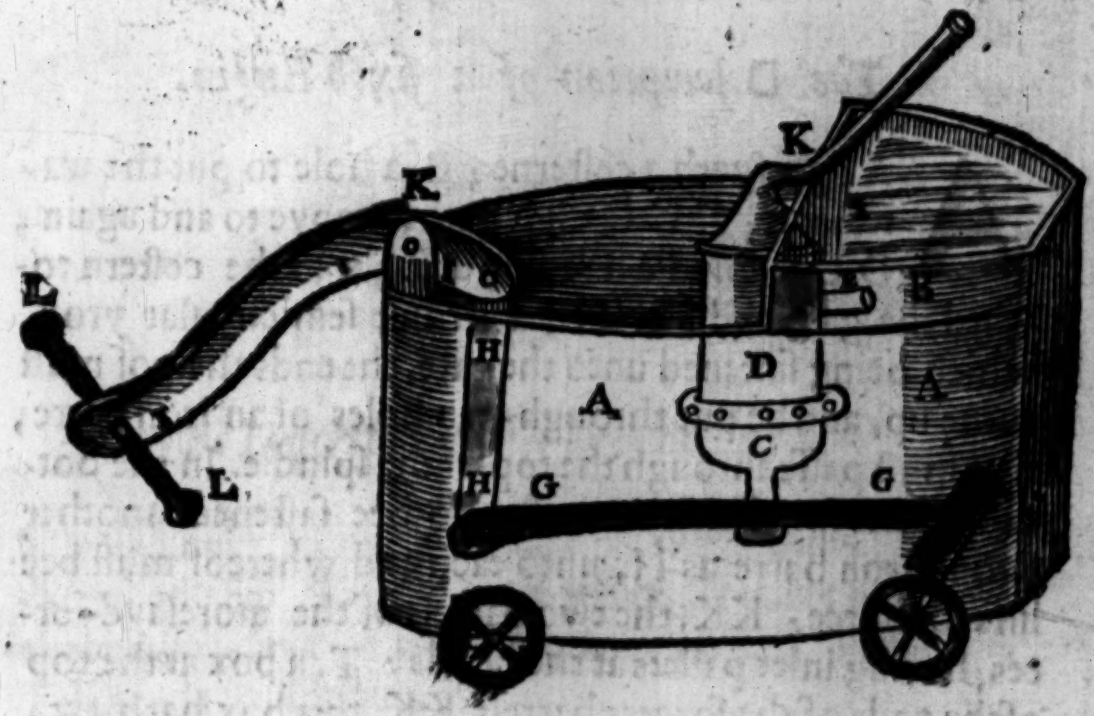
that

that holdeth C C, and B, together; F, the barrell of the force, fastned within two or three inches of the bottom of the cestern, at the end whereof must be a clacke or pallet as H G, a brasse barrell that proceedeth from the barrell of the force K, the pipe out of which the water is forced, L L, two holes to supply the water at.

The Description of a fifth Engin.

A A, signifieth a cesterne, B, another cesterne placed upon one end of it, C, a force, D, the forces barrell, with a hollow pyramid box sodered to the top of it, K, the Pipe for the water to be forced out at. At the bottom of the cestern B, there must bee a pallet or

Fig: 12



L clack

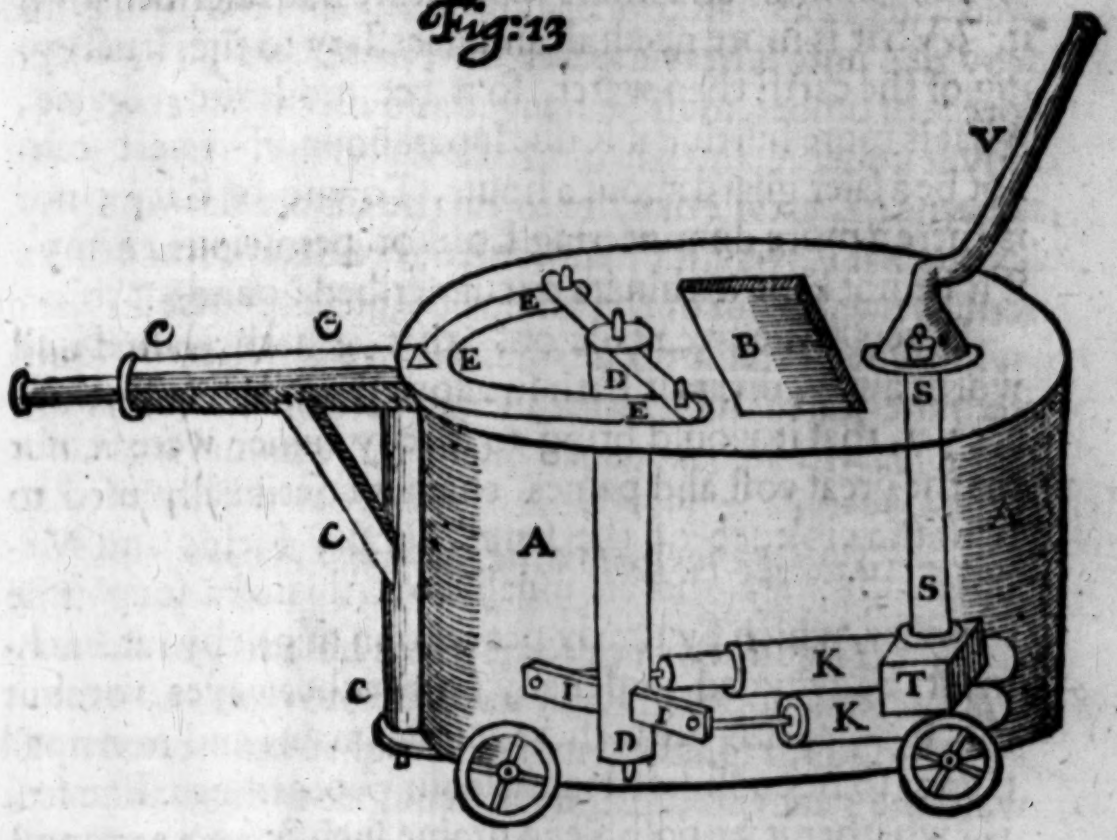
clack as E, which must passe through the side of the cesterne B, and enter the barrell of the Force; F, a peece of timber placed athwart, one end of the lower cestern, let in at both ends with Gudgins, that it may turne round. In the midst of this, there must be a mortise, and in it must be fast pinned another peece of timber, noted with G G; in the middest whereof must be joynted an yron rod noted with H H: the uppermost end of this rod, must bee joynted unto a heavie peece of Timber as I I; which peece of timber, must be hanged also on the cesterne, by a joynt under K, so that it may bee lift up, and let fall downe: L L two handles to lift the timber beame up by. Note that if you lift up the sayd beame I I, the force draweth the water out of the cestern B, into the barrell D, and when you let slack the beame, the weight thereof squirteth the water most violently out of the barrell at the pipe K.

The Description of a sixth Engin.

A A signifyeth a cesterne; B, a hole to put the water in at; C C C C, a gate to move to and again; D D, a spindle standing upright in the cestern toward the gate end; E E E, a strong semicircular yron, which being fastened unto the gate, the ends thereof must turne up, and be put through two holes of an iron barre, that must passe through the top of the spindle. In the bottom of the spindle there must also bee fastened another strong iron barre as I I, unto each end whereof must bee linked a force; K K, the two barrels of the aforesayd forces, having inlet pillets at their ends: T, a box at the top of the ends of the forcers barrels K K, this box hath two clacks

clacks at the bottom answering unto two holes made in the sayd barrels; S S, a pipe that proceedeth from the box T, this pipe entreth a pyramid box at the top of the cesterne, and in it is placed a succur. V, a pipe proceeding from the top of the pyramid out of which the water is forced.

Fig: 13



The Description of a seventh Engin.

THis Engin I have described in the seventh Chapter of this Treatise, to which I referre you, and whereas it is sayd in the Chapter A B C D signifies a Well, reade it a Cestern.

CHAP. 9.

THere is nothing (as the ſaying goes) bee it never ſo profitable, but that from the ſelfe ſame thing there may ariſe as great a diſcommodity, if it exceed the bounds and limits that nature hath aſcribed unto it. What is more needfull and neceſſary to the fructifying of the earth than water, ſo it bee moderate; againe, what is more hurtfull if it doe ſuperabound? There cannot be a ſafer guard about a houſe, Towne or City; nor is there a more domineering Lord or pernicious enemy, if it be not kept within its circumſcribed bounds.

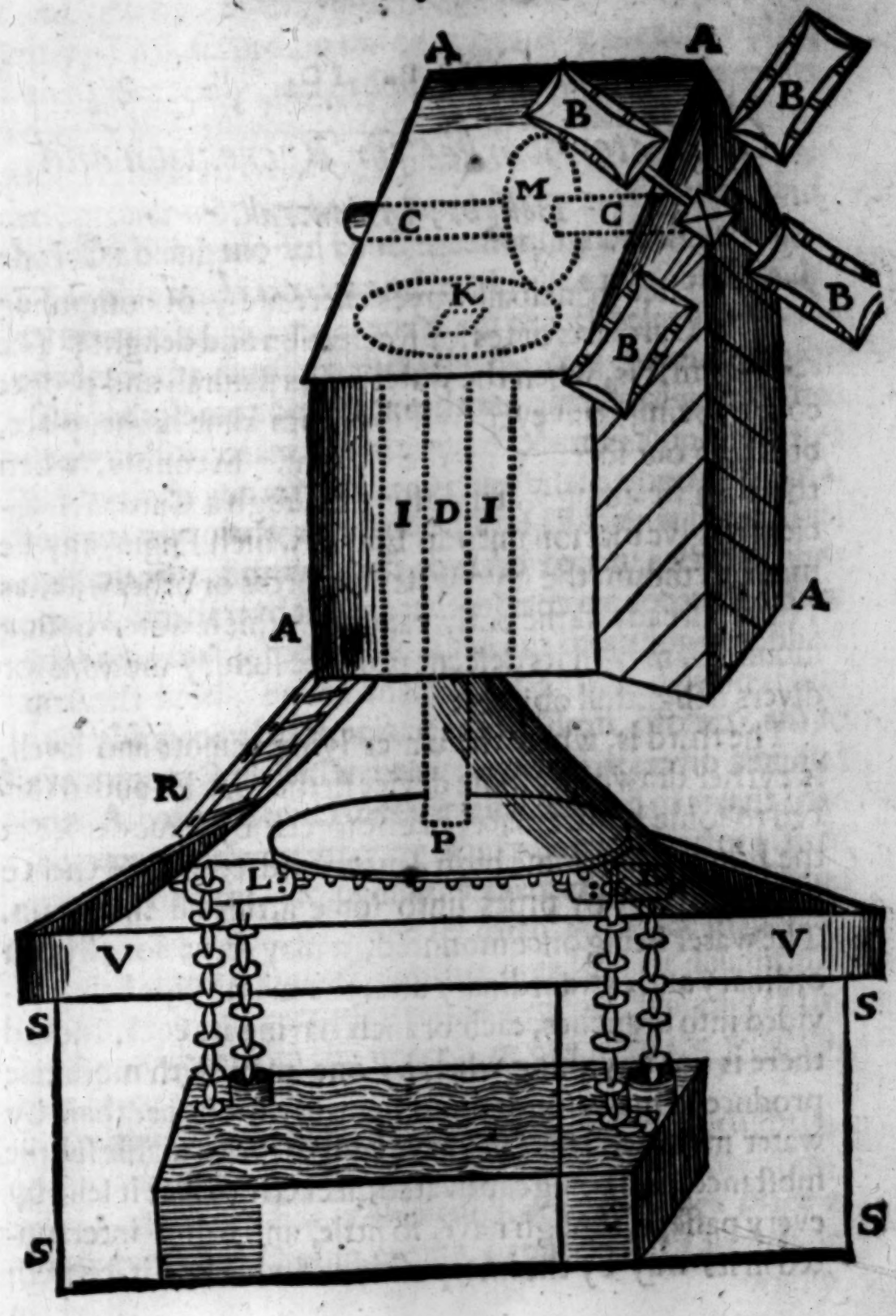
Divers Cities we reade of, that it hath waſted and worne away, divers it hath ſwallowed up; and ſome there are yet, that it would bring to ſpeedy ruine, were it not for the great coſt and paines that is continually uſed to reſiſt the violence of the ſame. Sundry Fields and Medowes there are, that are uſually overfloated a long time together, which by timely prevention might by intrenchments be avoyded, and many times otherwayes without much expences. Now there are two maine and principall things to be conſidered in theſe our proceedings. The firſt is, whether it be poſſible to draine ſuch & ſuch a ground. Secondly, how & by what means to effect the ſame. The Inundation or over-flowing of grounds, commeth ſundry wayes, but principally two. Firſt, by the overflowing of ſome adjacent or neare adjoyning River: Secondly, by the dreyning or deſcending of raine waters, from ſome higher grounds. For the firſt, conſider in the firſt place, whether the ground you deſire to dreyne, lye ſomewhat high or very low. Secondly, whether there bee a

conve-

convenient conveyance, without doing hurt unto other grounds: and lastly, whether the ground bee firme and fast, or marrish and spongie: Every of these being duely considered and examined will yield sufficient testimony of the possibility or not possibility of accomplishing your desire. Now for the second, by what meanes it is to bee performed, which are divers: If it come through the overflowing of some river or braneh of the Sea, the same must be dammed or block'd up with piles, gravel and such like. If there be any River neare adjoyning unto a floated ground, it hapneth oftentimes that the floated ground is so scituated, that the hurtfull water may by Trenches bee voided into the same; but if by channels onely it cannot be effected, yet the application of certaine Milles and Engines may doe it: and here I cannot with silence overpasse the great industry, labor and expences, of divers in forreine parts, whereby they have converted divers In-lands and parts of the Sea, into fields of corne and habitable cities. It hapneth many times, that the ground from whence we would soake the water, lyeth somewhat high, and then by petty channels, the water offending may bee drayned into some pond or great cesterne, made or placed at the lowest corner of thē same ground, and so by a spout passe the same upon a Mill wheele, which Mill may be employed for grinding of corne, for fulling of cloth, or for cutting of timber, and afterwards by a Trench convey it into some by River, where there is not such convenience, a Windmill may be placed againe. Where you cannot gaine sufficient advantage from the Wind, Horse milles may bee placed.

The Deſcription of a Wind-mill, to convey Water.

AAAA ſignifieth the body of the Mill, BBB the Sayles, CC the Spindle of the Sayles, M a wheele faſtened upon the Spindle, DD another Spindle having two wheeles faſtened unto it, one at the top noted with K, and another at the bottome noted with P, this ſpindle is made to turne in the maine Piller, upon which the body of the mill is made to turne; the ſayd piller is noted with IIII. The Wheele P moveth two other wheeles noted each of them with L: theſe two wheeles turne two chaines that are put over them. R the Ladder to goe up to the Mill. SS a Scaffold whereon the mill is placed. VV a battlement round about the top of the Scaffold, unto the inner ſide of this Scaffold, are faſtened divers yron rings, unto which by meanes of a cord that is to be faſtened unto the Ladder noted R, the Mill is to bee bound which way ſoever the Winde ſitteth. Marke the Figure following.


A
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Chap. 10.

Of Water-workes for Recreation and Delight; in Generall.

THree principall wayes there are, of composing Garden workes for Recreation and delight; The first is, when the water by its naturall and proper course, being conveyed by Pipes from some higher place, breaketh out forcibly in the descent. Secondly, when there is a steaming water passing through a Garden, sufficient to give motion unto an Engin, which Engin may be made to mount the sayd water by forces or otherwise, as I have already sufficiently taught; which water beeing mounted, may in its descent produce sundry motions for divers delightfull objects.

The third is, when the water lying remote and levell, is eyther drawne by some device in the Garden and so forced to some higher place, or else forced by some device at the Fouutaine to some high Turret, and conveyed thence unto the place by pipes unto some artificiall invention. The water being once mounted, it may serve for all both ordinary and extraordinary uses, the maine pipe being divided into branches, each branch having its cock. Indeed there is not any thing whereby one may with more ease produce so many sundry and contrary motions, than by water mounted: for (as I have sayd) it is of a masse subtile substance, and being captivated, seeketh to free it selfe by every passage, though never so little, and being interrupted in its way by the interposition of wheeles, it beateth them

them forward, or swayeth them downe more or lesse violently: First, according unto the quantity of the mounted water; Secondly, according unto the wideneſſe of its paſſage; and laſtly, according unto the diſtance and ſeituation of the ſayd wheeles, from the place of its eruption: theſe greater wheeles being moved they move leſſer, and the leſſer being moved by the greater, by devices artificially applyed, may produce other motions, muſicall ſounds and antique imitations, according unto the fancie and invention of the Artiſt or Engineer.

The whole may be contrived into a kinde of a Croſſe, beſet with ſtately ſtatues, in ſeverall ſtories one above another, the water aſcending the midſt, and privately deſcending upon certaine wheeles, which may turne other wheeles, whereupon may be fixed divers images; and ſo there will be a circular motion. By turning certaine lower cocks, or drawing backe ſhuts, other motions may bee made.

Or elſe it may be contrived into a Rock, which may have a doore for the Gardiner to enter in at, who beeing throughly acquainted with the ſame, may by turning of Cocks or wheeles or drawing backe ſhuts, paſſe the water from ſide to ſide, according as the motions are made to move. The Rock may bee ſet forth with the ſhapes of Serpents, Beaſts, and other, either dreadfull or delightfull ſpectacles. Some receiving motion, others changing their poſture, either from the water, or elſe from the wheeles that force the water.

Or it may be contrived into a Rock bedect with ſhels, glaſſe, and gliſtering ſtones, rudely and confuſedly compiled: on the out ſide within the Rock, may bee made a pretty conceited Dining roome, hanged with Tapiſtry, or

wildly and antiquely painted. Muſick alſo may bee privately diſpoſed upon one ſide of the roome. This roome may be made, ſo as it may be changed in an inſtant, and that more than once or twice, and the Muſick to change accordingly.

Or it may be contrived into a Fountaine beſet with divers naked figures.

Or you may place divers Images in ſundry and ſeverall parts of the Garden, the more antique and ridiculous, the more pleaſant and delightfull. Theſe being made hollow or perforated in divers parts, the water may be ſent unto them, by turning of divers ſtock cocks, and ſo ſpin out thereat, ſo that the ignorant perſon can walk no where to gape about, but he ſhall bee waſhed whenſoever the Gardiner pleaſeth, or if his owne follly be ſuch as to bee medling with what he is unacquainted withall.

CHAP. II.

Of Voices, Calles, Cryes, and Sounds.

IT is neceſſary to ſpeake ſomewhat in this Booke, of Voyces, Calles, Cryes, and Sounds. They are known among ſome Shopkeepers, by the names of Calles, and there are long white boxes of them, which are tranſported hither from France, each box containing eleven in number, the names whereof follow.

A Cooko	A Quaile
A Peacock	A Small Bird
A Bitern	A Hare
A Leurat	A Drake
A Stag	A Hedgehog A Fox.

They

They are very seldome sold alone, and altogether at a very deare rate. There is no difficulty in their making, nevertheleſſe for to satisfie the expectation of some, I have not onely set downe their Figures, but also explicated the same so farre as I thought needfull: Certaine others there are, that I found out when I made the forenamed, and I doubt not but if another shall essay to make them againe, he may adde some other unto their number.

Of the Cooko Pipe.

FIrst you must turne a peece of wood hollow, like unto a steele-sticke, about three inches deepe. Let the Diameter of the hollowneſſe towards the top, be about one inch and a quarter or leſſe, make then a stopple unto it, about a quarter of an inch thicke, cut a little slip from off one side of it. Thē put it into the mouth of the other turned wood, and cut a little square hole in the sayd turned peece, so that the lower side of the sayd hole may bee equall with the bottom that you put in. Then bore a small hole in the round end of the hollow turned wood, about the bigneſſe of the tag of a point, bore also such another in the middle of the bottom that you put in. Then hold it between your thumbe and middle finger, with the flat end towards your mouth, and blow into the pipe hole of the same, obſerving this; That your blast must be doubled according unto the number of the Syllables that the voice doth containe, as Coo-ko; now towards the end of the second syllable, you must stop the top of your fore-finger, upon the hole of the round end of the pipe, which maketh the second syllable sound flat, and so it will give the true and lively sound of Cooko: which when it is

perfect and liketh you, you may glew the bottom fast in: The same pipe giveth the right and lively sound or cry of an Owle: Hoo ho ho ho hoo, but you must as I have said, double your breath according unto the multitude and pronuntiation of the syllables contained in the said voice, the first whereof is long, the three next short, and the last long.

A Cock.

I Have produced the voice of a Cock out of the former pipe, onely by boring 4. holes round about the side, towards the smaller end, one opposite to the other, and stopping the two little holes at the ends.

The Drake, Bitern, Hare, Leurat, Peacock and Hedgehog.

THe Pipes that sound the Drake, Bitern, Hare, Leurat, Peacock and Hedghog, are almost made after one manner, and it is the size alone that alters the voice, the description of which I have set downe in generall as followeth.

They consist each of them of foure severall parts, one to be skrewed or wrung upon another. The first part is like the mouth of a Cornet, and it is noted with the Letter A; the second, is a peece of wood made hollow quite thorow, into one end whereof the peece A is to be wrung, and the other end is to be upon another peece, as C, but this part before such time as you wring it on, must have the following brasse fastened in it.

Make or cause to be made a peece of brasse like unto a Cane split in the middle as A, fit a cover unto it, of thin yellow

yellow lattin such as they tag points withall, that it may lye close all over the top of the hollowneſſe of the afore said peece of braſſe. Let this tongue or couer beare a little from the braſſe, towards that end that is closed. Note that the middlemoſt wooden peece, muſt be of ſufficient wideneſſe for the tongue to play in without let or hinderance. The like braſſes, but of different ſizes muſt be made, for every of the forenamed Pipes: for it is the ſize of the Braſſe (as I have told you) that alters the voice.

A Stag and Foxe.

THe Stag and Foxe cryes, are made like unto the aforeſaid; only their tongues beare a little more from their braſſes, and there is no cornet mouth upon them.

The Hogge, Cow, and Lyon.

THe Hog, Cow and Lyons cryes, may bee imitated after the ſame manner as the Stag and Foxes, but the braſſes of theſe muſt bee fuller, and the lowermoſt Wood wherein the braſſes muſt be faſtened, muſt be longer.

A Plover and a Puppie.

MAke a ſmall braſſe in like manner as you made the Peacocks, & if you blow at the cloſe end it wil yeeld the voice of a Plover, but if you put the open end into your mouth, and draw in your breath, it will give a ſound juſt like the whining of a Puppie.

A Call for ſmall Birds.

THis is in all reſpects made like unto a whiſtle, onely there is a little hole at the lower end, as big as you may put the tag of a point into.

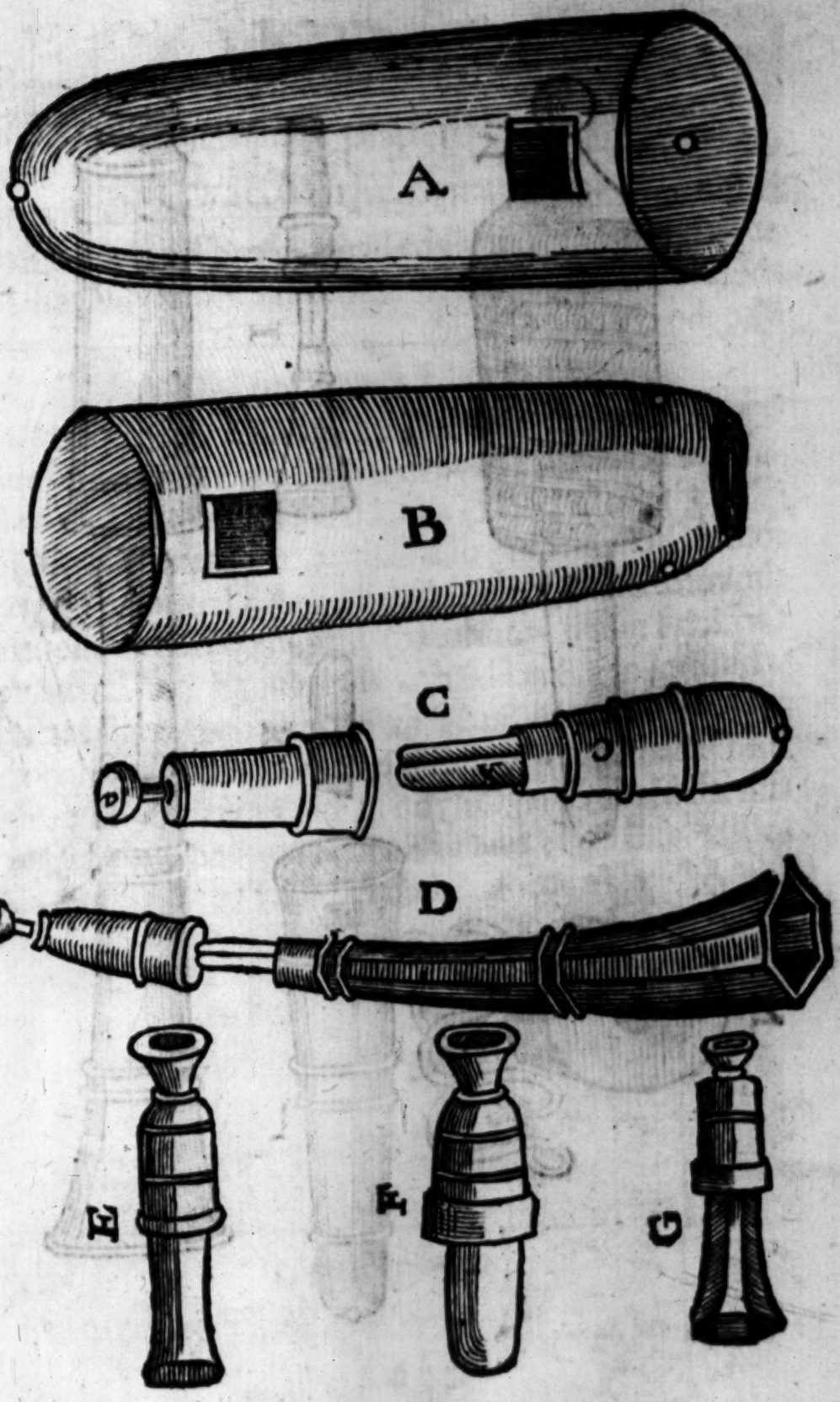
A Quaile Call.

A Quaile Pipe or Call is a ſmall whiſtle, and there is over the top of it ſome writhed wyer, which muſt bee wrought over with leather; hold the whiſtle in your left hand, and the top of the leather betweene the fore finger and thumbe of your right hand, and by pulling ſtreight the ſaid leather, and letting it ſlacke nimbly, it will ſound like the cry of a Quaile.

A Larke, Linnet, and Kite.

THe former Call may be ſounded by a Sparrow call, wherewith I have heard a Frenchman ſound the ſinging of a Larke; alſo, I have heard him by the ſame, ſound the whiſtling of a Linnet, the ſame call will ſound the voice of a Kite and Quaile. An Iriſhman I have ſeen (which I much wonder at) imitate with his mouth the whiſtling of a Blackbird, a Nightingall and Lark, yea almoſt of any ſmall Bird, as exquiſitely almoſt as the very Birds themſelves; and all is by the cunning holding the artificiall blade of an Onyon in his mouth. The Figures follow, and every one of them is marked with a letter.

A	Signifyeth the call for	a Kooko and an Owle.
B		a Cock
C		a Drake.
D		a Bitern.
E		a Hedgehog.
F		a Leurat.
G		a Peacock.
H		a Stag.
I		a Foxe.
K		a Plover and a Puppie.
L		a Call for Small Birds.
M		a Quaile.
N		a Kyte, Larke and Linet.


A
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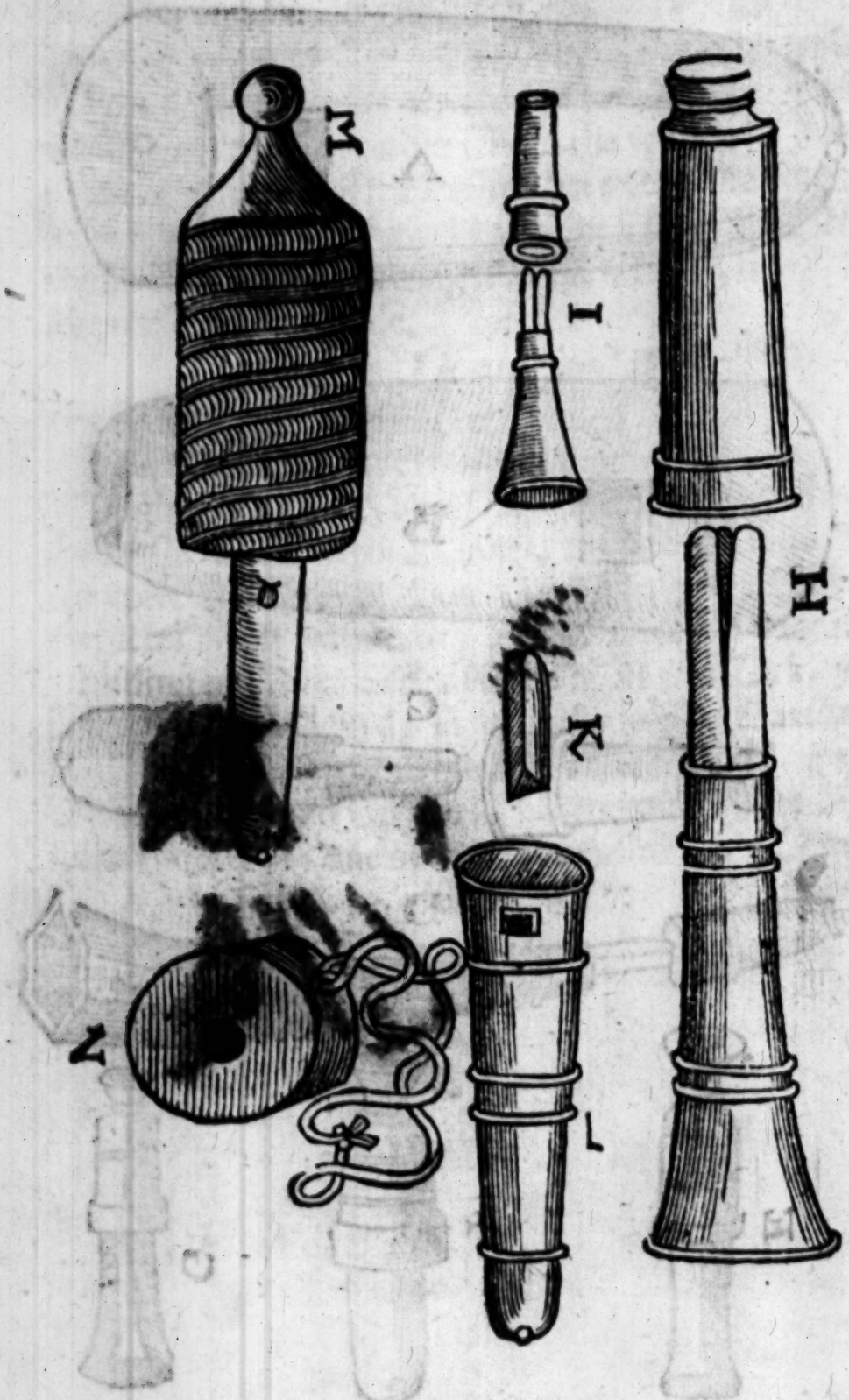
G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THE SECOND BOOKE

Teaching moſt plainly, and withall moſt exactly, the compoſing of all manner of Fire-works for Tryumph and Recreation.

By IOHN BATE.

LONDON,
Printed by *Thomas Harper* for *Ralph Mab*.
1635.

To the Reader.

COurteous Reader, I once desisted since I began this Worke, by reason of the occurrents of certain Authors, that contrary unto my knowledge had laboured so fully herein; but after consideration had (that for the most part they were but translations) I thought it might be no lesse lawfull and commendable for mee than for others, to communicate unto such as are yet desirous of further information, that wherein I have bestowed both cost and paines. Notwithstanding, I have so used the matter, as that I might not derogate from the estimation had of others to increase mine owne. Reade it throughly, judge indifferently, and if thou likest it, practise considerately. If thou art ignorant herein, I am

ſure it will inſtruct thee, and though well experienced (which perhaps thou art) I make no queſtion, but that thou maiſt finde ſomewhat which thou haſt not heard of before; So farewell.

Your Well-willer

J. B.

Of Fire-workes.

I Have ever found (in conference with divers desirous of instruction in any Art or Science whatsoever) that those things whose causes have been obvious unto apprehension, have more affected the learner. Wherfore I thought good, before I came to the matter it selfe, to set downe some few Præcognita or Principles (as I may so call them) whereby such as are ingenuous, upon occasion, may informe themselves, if they stand in doubt of the cause of any thing that is hereafter taught.

Certaine Præcognita *or Principles, wherein are contayned the causes and reasons of that which is taught in this Booke.*

1 THe foure Elements, Fire, Ayre, Earth, and Water, are the *prima principia* (I meane the materialls) whereof every sublunary body is composed, and into the which it is at last dissolved.

2 Every thing finding a dissolution of those *naturæ catenæ*, that is, meanes whereby their *principia* are connected and joyned together, their lighter parts ascend upward,

ward, and these that are more grosse and heavy, doe the contrary.

3 It is impossible for one and the selfe-same body to possesse at one time two places; It followeth therefore, that a dense body rarified, and made thin, eyther by actuall or potentiall fire, requireth a greater quantity of room to be conteyned in, than it did before. Hence it is, that if you lay your hand upon a glasse, having a straight mouth reverst into a dish of water, it rarifieth the ayre contayned therein, and makes it breake out thorow the water in bubbles. Also, that gun-powder inclosed in the barrell of a gun, being rarified by fire, applyed unto the touch-hole, it seeketh a greater quantity of roome, and therfore forceth the bullet out of the barrell. This is called violent motion.

4 According unto the strength and quantity of a dense body rarified, and according unto the forme and length of its inclosure, it forceth its compresser further or nearer at hand.

Thus much shall suffice to have spoken concerning the *Præcognita*: Now I will passe *ad majora, & ad magis necessaria*: to wit, those necessary Instruments, and severall sorts of Ingredients, that ought to be had in readinesse.

As for the instrumens they are these; Morters and Pestles, Serces, also severall sorts of Formers, Paper, Parchment, Canvas, Whipcord, strong binding thread, Glew, Rosin, Pitch, with divers vessels meet to containe and mingle your compositions in. The ingredients likewise are chiefly these, Saltpeter, Rochpeter, Sulpher, Charcoale, good Gunpowder, Filings of steele, oyle of Peter, and spirit of Wine.

Instructions

Instructions for chusing your ingredients.

SAltpeter is very good, if that being layd upon a board, and fire put to, it rise with a flamed ventosous exhalation raysing no scum, nor leaving no pearle, but onely a blacke specke burnt into the boord.

The best brimstone, is quick brimstone, or live sulphur. and that sort is best that breaketh whitest; if this cannot be gotten, take of the whitest yellow brimstone.

The best Coales for use are the sallow, willow, hazell and beech; onely see they be well burnt. Every of these ingredients must be powdred finely and searsed.

All kindes of gunpowder are made of these ingredients impasted, or incorporated with vineger, or aquavitæ, and afterward grayned by art. The Saltpeter is the Soule, the Sulphur the Life, and the Coales the Body of it. The best sort of powder may be distinguished from others, by these signes:

1 If it be bright and incline to a blewish colour.

2 If in the handling it prove not moyst but avoydeth quickly.

3 If being fired, it flash quickly, and leave no dregs nor setlings behinde it.

A device to try the strength of divers sorts of Gunpowder.

IF so be you have at any time divers sorts of Gunpowder, and it is your desire to know which of them is the strongest, then you must prepare a Box, as A, B, being foure inches high, and about two inches wide, having a

lid

lid joynted unto it. The box ought to be made of yron, braſſe, or copper, and to bee faſtned unto a good thick plank, and to have a touch hole at the bottom, as O, and at that end of the box where the hinge of the lid is, there muſt ſtand up from the box a peece of yron or braſſe, in length anſwerable unto the lid of the box: this peece of yron muſt have a hole quite thorow it, towards the top, and a ſpring, as A, G, muſt bee ſcrewed or riveted, ſo that the one end may cover the ſayd hole. On the top of all this iron, or braſſe that ſtandeth up from the box, there muſt bee joynted a peece of iron (made as you ſee in the figure) the hinder part of which is bent downward, and entreth the hole that the ſpring covereth; the other part reſteth upon the lid of the box. Open this box lid, and put in a quantity of powder, and then ſhut the lid down, and put fire to the touch hole at the bottom, and the powder in the box beeing fired, will blow the box lid up the notches more or leſſe, according as the ſtrength of the powder is: ſo by fyring the ſame quantity of divers kindes of powders at ſeverall times, you may know which is the ſtrongeſt. Now perhaps it will bee expected that I ſhould ſpeak of the making of Saltpeter, Gunpowder, Coales, with the refining of Sulphur: but becauſe they are ſo commonly to bee had, and to bee bought at better rates than I know they can bee made by any that intend it for their private uſe, I have forborne it: There are divers I am ſure that would willingly bee in action:

action: I have thought fitting therefore to set downe the collection of naturall Saltpeter, which is a kinde of white excrescence growing upon stone walles, and (as I have seene great store) in the arches of stone bridges. First therefore gather this white excrescence, and adde unto it Quick lime, and Ashes, mingle them; and put them into a halfe tub that hath a hole to draw the liquor out at; then put into this halfe tub warm water, and let it stand untill all the peter be dissolved; let it then draine out at the hole by little and little, and if the liquor be not cleere, double a brown paper, and put it within a tunnell, and straine the liquor through it. Then boyle it and scum it untill it be ready to congeale, neither too hard, nor yet too tender: then take it from the fire, and put it into shallow vessels, either of earth or brasse; set them in a cold place two or three dayes, and it will shoot into ysicles, and this is called Rochpeter. Thus much for the ingredients. Now I am come unto the Formers, the number whereof I cannot certainly determine, because it dependeth upon the variety of each particular persons invention. Now that I may formally proceed, I will first make some distinction of each kinde in generall; and then I will speake of every particular contained in each generall. Fire-works are of three sorts.

1 Such as operate in the ayre, as Rockets, Serpents, Raining fire, Stars, Petards, Dragons, Fire drakes, Fiends, Gyronels, Firewheeles, or Balloons.

2 Such as operate upon the earth, as Crackers, Trunks, Lanterns, Lights, Tumbling bals, Saucissons, Towers, Castles, Pyramids, Clubs, Lances, Targets.

3 Such as burn in or on the water, as Rockets, Dolphins, Ships, Tumbling bals, Mermaides.

Part of either of the three kindes are ſimple, and part are compounded; part alſo are fixed, and part moueable. Firſt, I will treat of the diuers compoſitions, and then of the Formers, Coffins, and manner of compoſing euery of them.

Of the diuers compoſitions of Fire-works.

FIrſt, of the compoſitions of fire-workes, for the ayre; and therein firſt I will ſpeake of the compoſitions for rockets, becauſe that all moueable fireworkes have their motion from the force of them accordingly applyed.

Compoſitions for Rockets of all ſizes, according unto the preſcription of the noted Profeſſors, as Mr. Malthus, *Mr.* Norton, *and the French Authour*, Des Recreationes Mathemat ques.

TAke this from me, whoſoeuer thou art that deſireſt to be inſtructed. Neuer relie abſolutely upon a compoſition, nor make many Rockets, or other ſorts of fire-workes of a compoſition, untill ſuch time as thou haſt made triall once or twice of the ſame, leſt that thou miſſe of thy aime, but after triall you may proceed and performe your intentions with credit. By the compoſitions you may make a gueſſe, and as they proue you may allay or quicken them accordingly.

A Compoſition for Rockets of one Ounce.

TAke of gun-powder, ſaltpeter and charcoale, of each one ounce and a halfe, mingle them together, and it is done. Note here, as I told you before, that all your ingredients ought to be firſt powdred by themſelues, and afterwards mixed very well together.

A Compoſition for Rockets of two and three ounces.

TAke of gunpowder foure ounces and a halfe, ſaltpeter one ounce, mixe them together.

A Compoſition for Rockets of foure ounces.

TAke of gunpowder foure pounds, ſaltpeter one pound, charcoale foure ounces, mingle them together.

A Compoſition for Rockets of foure ounces.

TAke of gunpowder foure pounds, ſaltpeter one pound, charcoale foure ounces, brimſtone halfe an ounce, mingle them together.

A Compoſition for all middle ſized Rockets.

TAke of gunpowder one pound, two ounces of charcoales; mingle them.

A Compoſition for Rockets of five or ſixe Ounces.

TAke of gunpowder two pound five ounces, of ſaltpeter halfe a pound, of charcoale ſixe ounces, of brimſtone and yron ſcales, of each two ounces, mingle them.

A Compoſition for Rockets of ten or twelve Ounces.

TAke of gunpowder one pound and one ounce, ſaltpeter foure ounces, brimſtone three ounces and a halfe, charcoale one ounce, mingle them.

A Compoſition for Rockets of one pound, or two.

TAke of ſaltpeter twelve ounces, gunpowder twenty ounces, and charcoale three ounces, quick brimſtone and ſcales of iron, of each one ounce, mingle them.

A Compoſition for Rockets of eight, nine, and ten pounds.

TAke ſaltpeter eight pounds, charcoale two pounds twelve ounces, brimſtone one pound foure ounces.

Note that no practitioner (how exact ſoever) ought to relye upon a receipt, but firſt to try one Rocket, and if that be too weake adde more gunpowder, if it bee too ſtrong let him adde more charcoale untill he finde them flye according unto his deſire. Note that the charcoale is onely to mitigate the violence of the powder, and to make the tayle of the Rocket appeare more beautifull. Note alſo that the ſmaller the Rockets be, they need the quicker receipts,

ceipts and that in great Rockets, there needeth not any gunpowder at all.

The Compoſition for middle ſized Rockets may ſerve for Serpents, and for rayning fire, or elſe the receipt for Rockets on the ground, which followeth hereafter.

Compoſitions for Starres.

TAke ſaltpeter one pound, brimſtone half a pound, gunpowder foure ounces, this muſt be bound up in paper or little ragges, and afterwards primed.

Another receipt for Starres.

Take of ſaltpeter one pound, gunpowder and brimſton of each halfe a pound; theſe muſt be mixed together, and of them make a paſte, with a ſufficient quantity of oyle of peter, or elſe of faire water; of this paſte you ſhal make little balles, and roll them in drie gunpowder duſt; then dry them, and keepe them for your occaſions.

Another.

Take a quarter of a pinte of *aqua vitæ*, and diſſolve therin one ounce, and a halfe of camphire, and dip therein cotten bumbaſt, and afterwards roule it up into little balles; afterwards rowle them in powder of quicke brimſtone, and reſerve them for uſe.

Another receipt for Starres, whereof you may make fiends and divers apparitions according unto your fancie.

Take gum dragant, put it into an yron pan, & roſt it in the Embers; then powder it, and diſſolve it afterwards in *aqua vitæ*, and it will become a jellie, then ſtraine it; diſſolue alſo camphire in other *aqua vitæ*. Mixe both theſe diſſolutions together, and ſprinkle therein this following powder.

Take ſaltpeter one pound, brimſtone halfe a pound, gunpowder three pound, charcoale halfe a pound; when you have mingled and ſtirred them well together, mixe them well with the aforeſaid jelly, and then make it into little balles, or into what faſhion elſe you pleaſe, then cool them in gunpowder duſt, and keep them for uſe.

Compoſitions for receipts of fire-workes, that operate upon the earth.

FOr Rockets there needeth onely gunpowder finely beaten and ſearced.

Likewiſe for all the other ſorts, ſearced gunpowder will ſerue, which may be abated, or alayed with charcoal duſt at your pleaſure.

Compoſitions for fire-workes that *burne upon or in the Wa-* ter.

A Receipt for Rockets that burne upon the water.

TAke of ſaltpeter one pound, brimſtone halfe a pound, gunpowder halfe a pound, charcoales two ounces. This compoſition will make the Rockets appeare with a great fiery taile. If you deſire to have it burne cleare, then take of ſaltpeter one pound, three ounces of gunpowder, brimſtone halfe a pound.

A Receipt of a compoſition that will burne, and feed upon the water.

TAke maſticke halfe a pound, white Frankincenſe, gum, ſandrake, quickelime, brimſtone, bitumen, camphire, and gunpowder, of each one pound and a halfe, roſin one pound, ſaltpeter foure pounds and a halfe, mixe them all together.

A Receipt of a Compoſition that will burne under water.

Take brimſtone one pound, gunpowder nine ounces, refined ſaltpeter one pound and a halfe, camphire beaten with ſulphur and Quickſilver; mixe them well together with oyle of peter, or linſeed oyle boyled, untill it will ſcald a feather. Fill a canvas ball with this compoſition, arme it, and ballaſt it with lead at the bottome, make the vent at the top, fire it well and caſt it into the water, and it will fume and boyle up ſlowly.

A Receipt of a Compoſition that will kindle with the water.

Take of oyle of Tile one pound, Linſeed oyle three pounds, oyle of yelks of egges one pound, new quicke lime eight pounds, brimſtone two pounds, camphire foure ounces, bitumen two ounces; mingle all together.

Another.

Take of Rochpeter one pound, flower of brimſtone nine ounces, coales of rotten wood ſixe ounces, camphire one ounce and a halfe, oyle of Egges, and oyle of Tile enough to make the mixture into a paſte.

Or take callamita one pound, ſalt-niter and aſphaltum, of each foure ounces, quicke brimſtone three onnces, liquid varniſh ſixe ounces; make them all into a paſte. Put eyther of theſe compoſitions into a pot wherein is quicke lime, ſo that the lime come round about the paſt; then lute it faſt, binde it cloſe with wires, and ſet it in a limekil a whole baking time, and it will become a ſtone that any moiſture will kindle.

If you make a hole in the top of an Egge, and let out all the meat and fill the ſhell with the following powder, and ſtop the hole with wax, and caſt it into a running water, it will break out into a fire.

Take

Take of ſalt-niter, brimſtone, and quick lyme, of each a like quantity, mixe them.

How to make ſtouple, or prepare cotten-week to prime your fire-workes with.

TAke cotten-week, ſuch as the Chandlers uſe for candles, double it ſix or ſeven times double, and wet it throughly in ſaltpeter water, or *aqua vitæ*, wherein ſome camphire hath beene diſſolved, or, for want of either in faire water; cut it into divers peeces, rowle it in mealed gunpowder, or powder and ſulphur; then dry them in the Sun, and reſerve them in a box where they may lye ſtraight, to prime Starres, Rockets, or any other fire-works.

How to know the true time, that any quantity of fired Gun-match ſhall doe an exployt at a time deſired.

TAke common gun-match, rub, or beat the ſame a little againſt a poſt to ſoften it; then either dip the ſame

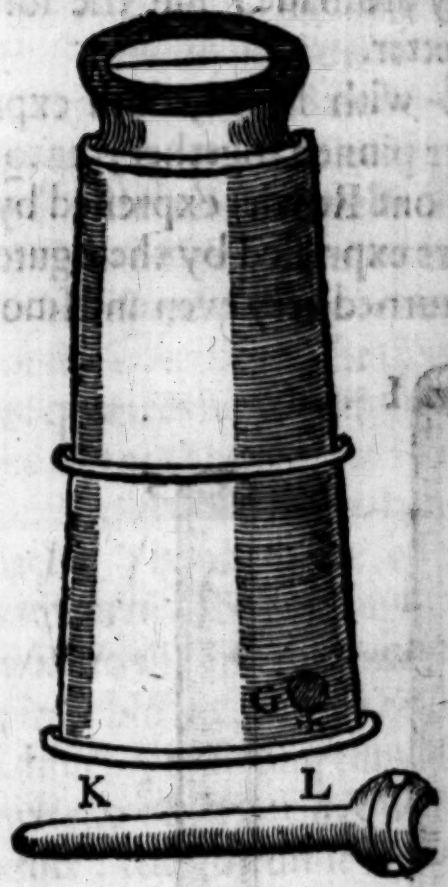
in ſalpeter water, and dry it againe in the Sunne, or elſe rub it in a little powder and brimſtone beaten very ſmall, and made liquid with a little *aqua vitæ*, and dryed afterwards; trie firſt how long one yard of match thus prepared will burne, which ſuppoſe to be a quarter of an houre, then foure yards will be a juſt houre. Take therefore as much of this match as will burne ſo long as you will have it to be ere your worke ſhould fire, binde the one end unto your worke, lay looſe powder under, and about it lay the reſt of the match in hollow, or turning ſo that one part of it touch not another, and then fire it.

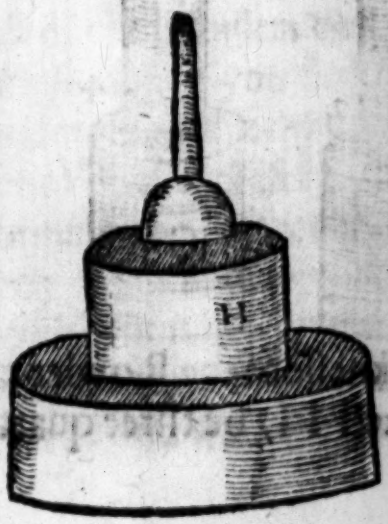
A Water called Aqua Ardens.

TAke old red wine, put it into a glaſſed veſſell, and put into it of orpment one pound, quicke ſulphur halfe a pound, quicke lime a quarter of a pound; mingle them very well, and afterwards diſtill them in a roſe water ſtill: a cloth being wet in this water will burne like a candle, and will not be quenched with water.

The Formers are inſtruments wherewith the Coffins for the fire-works are made and formed, whereof in order; and firſt for Rockets that operate in the ayre. The Formers for Rockets conſiſt of two parts, repreſented by the two next figures following, the uppermoſt whereof repreſenteth the body of the Former, which muſt be made of Maple, Wallnut tree, or of other cloſe and well ſeaſoned wood, or elſe of braſſe, ſeven inches, wanting halfe a quarter in length, turned equally, and exactly hollow quite through the Diameter of whoſe hollowneſſe, repreſented by the line at the top marked at each end with a, e, muſt be one inch and a quarter; the breech of the former

is

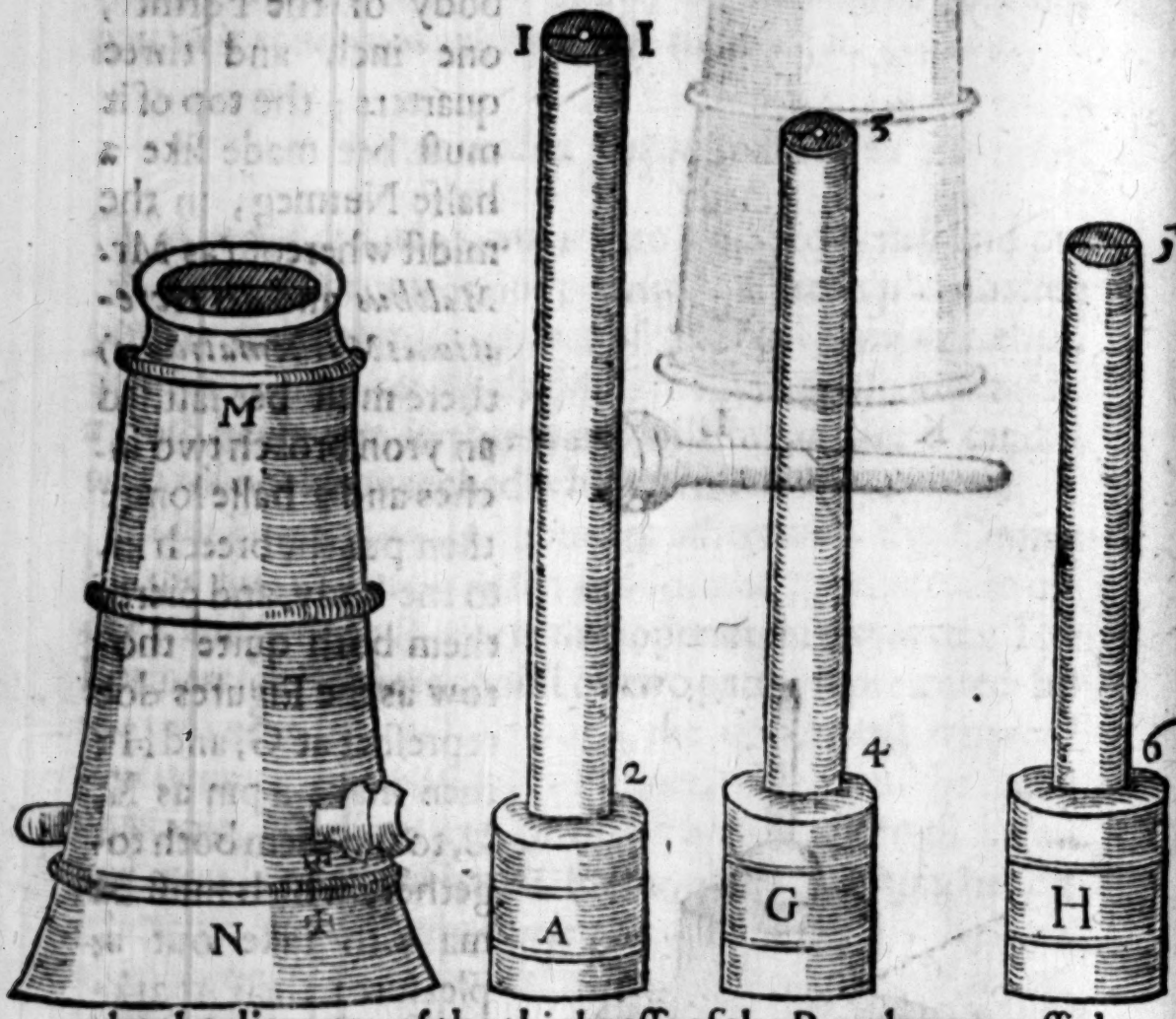




is represented by the lowest figure, the upper part whereof, must be made to enter the body of the Former; the height of the whole breech, beside the broach is 3. inches and a halfe; it entreth the body of the Former, one inch and three quarters; the top of it must bee made like a halfe Nutmeg, in the midst whereof (as Mr. *Malthus* and *des recreationes Mathematiques*) there must bee fastned an yron broach two inches and a halfe long: then put the breech into the body, and pierce them both quite thorow as the Figures doe represent at G, and H; then make a pin as K, L, to pin them both together, which must be made to take out at pleasure: then marke both the body and breech neare the sayd hole with this * or any

other mark, that you may thereby know how to fit them afterwards. But *Mr. Norton* willeth to bore the Rockets with a Bodkin after they are made: But the former in my opinion, I hold the better.

The next figure marked with M, N, doth expreſſe both the parts of the former pinned together; unto this Former there muſt be made one Rowler expreſſed by the figure A; alſo two Rammers expreſſed by the figures G H; they muſt all of them be turned very even and ſmooth;

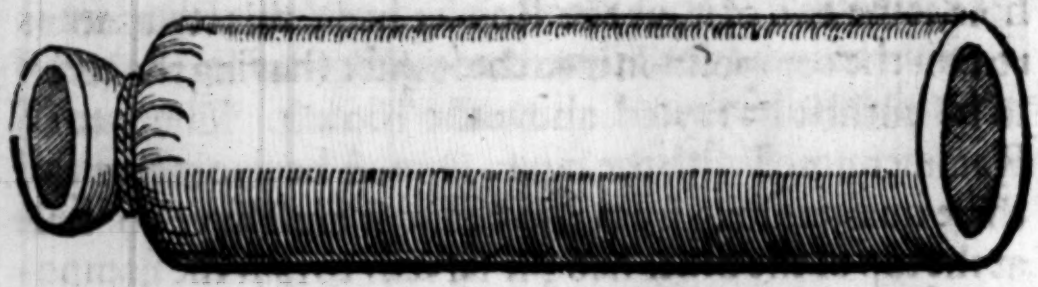


let the diameter of the thickneſſe of the Rowler expreſſed by the line on the top marked I I, be three quarters of an inch,

inch, let it be eight inches long from I, to 2, and have a hole bored in the very midſt of the end, ſo wide and ſo deepe, that all the broach of the former may enter the ſame: this is to rowle the coffin of paper upon. The firſt Rammer noted with the figure G, muſt bee ſeven inches and a halfe long, from 3. to 4. and have a hole at the end of it, as the Rowler had; this Rammer is to ram the compoſition into the former (having the coffin in it) untill it be rayſed above the broach. The ſecond Rammer noted with the figure H, muſt be five inches and three quarters long from 5. to 6. and it muſt have no hole at the top as the other had; it ſerveth to ram the compoſition into the coffin, when it is once rayſed above the broach. The diameter of the thickneſſe of theſe two Rammers muſt be a thought leſſe than the diameter of the Rowler, to the end they may not hurt the coffin, being driuen in. Now to make the coffins you muſt take paper, parchmenr, or ſtrong canvaſſe, rowle it hard upon the Rowler, ſo often untill it will go ſtiffe into the body of the Former: then thruſt it Rowler and all thorow the ſayd hollow body of the Former; put then the broach of the Formers breech into the hole of the Rowler, and with a peece of ſtrong packthred choake the coffin within halfe an inch of the Rowlers end (which you may do beſt, and with moſt eaſe, if you firſt dip the end of the coffin into faire water, ſo that it may be wet quite thorow) after you have choked the coffin, you muſt thruſt the breech of the Former, the coffin alſo with the Rowler in it, up into the body of the Former: then pin the breech faſt to the body of the former with the pin, and on the Rowler give one ſtroake or two with a mallet lightly, then unpin the breech, and with the Rowler thruſt the coffin out of

the bottom of the former, lay it by untill the end be thorow dry.

Thus you may at leiſure times make divers coffins ready to uſe upon any occaſion. The following figure expreſſeth an empty coffin.



Take one of theſe coffins, put it into the Former, and take the compoſition for middle ſized Rockets (mentioned before) and put thereof ſpoonfull after ſpoonfull, untill you have filled the coffin unto the top of the Former, after the putting of every ſecond ſpoonfull into the coffin, with a mallet give two or three blowes upon the head of the rammer, that the compoſition may bee well rammed into the coffin: every third or fourth driving M. *Norton* wiſheth (if the rockets are to be fired in three or foure dayes) to dip the rammer in gum dragant, and camphir diſſolved in ſpirit of wine, or good *aqua vitæ*: but if it will be a moneth before they will bee fired, then dip the rammer in oyle of peter. If you would have the rocket to give a report or blow, then within one diameter of the top, drive a bottom of leather, or ſixe or eight double of paper, pierce and prime eyther of them thorow in three or foure places, and fill the reſt of the coffin with whole gunpowder; afterwards drive another botto n of leather,

and

and then with ſtrong packthred choak the coffin cloſe unto it: then take the rocket out of the Former, and prime it at the broach-hole with a peece of prepared ſtouple, and binde unto it a ſtraight rod 6. or 7. times the length of the rocket, and ſo heavie, that being put on your finger, it may ballaſt the rocket within two or three diameters of the ſame: marke the following figure, which repreſents a Rocket ready made and finiſhed; A B, the rocket, C the ſtouple that primeth it, D E F, the rod bound unto the Rocket with two ſtrings, G, H, I, the hand that poyſeth it.

How to make Serpents.

THe coffins for ſerpents are made of paper rowled nine or ten times upon a Rowler not much thicker than a gooſe quill, and about foure inches long. The coffins muſt bee choaked almoſt in the midſt, but ſo that there may bee a little hole, through which one may ſee: the longeſt part of the coffins for Serpents muſt be filled with the compoſition ſpecified before: if you would have it wamble in the ayre, then choak it not after the compoſition, but if you would have it wamble, then halfe-choak it, as is demonſtrated by the following figure, the ſhor-

ter

ter end of the coffin muſt bee filled with whole gunpowder, and choaked quite up, as appeareth at B, in the figure M, N, O, which is the figure of a Serpent ready made.

How to make raining fire.

TAke divers gooſe quils, and cut off the hollow ends of them, and fill them with the compoſition before mentioned, ſtopping them afterwards with a little wet gunpowder, that the dry compoſitions may not fall out.

How to make Starres.

IHave ſufficiently taught the making of theſe in deſcribing their compoſitions, wherefore I will now onely preſent the figures of them unto your view; A, A, ſignifieth two that are bound up in paper or cloth, and pierced, and primed with ſtouple: the other two, E, E, ſignifie thoſe that are made up without paper, and need no priming more than the powder of fulphur duſt that they are rowled in.

How to make Petards.

YOu muſt make the coffins for them eyther of white yron, or elſe of paper, or parchment rowled upon a Former for the purpoſe, and afterwards fitted with a cover, which muſt be glewed on: theſe coffins muſt be filled with

with whole gunpowder, and pierced in the midst of the broad end, and primed thereat with prepared stouple; the paper ones must be covered all over with glew, and the pierced. The figure of a Petard ready made, and primed, is signified by the Figure E.

How to make compounded Rockets.

FIrst you must make the Rocket I taught you before; you must not choake the end of it, but eyther double downe halfe the coffin, and with the rammer and a mallet, give it one or two good blowes; then with a bodkin pierce the paper unto the composition, or else drive a bottome of leather fitted unto the bore of the Rocket, and pierce it thorow in two or three places; then pare or cut off the coffin equall thereunto; to this end of the Rocket you must binde a coffin wider a great deale than the rocket is; strew into it a little gunpowder dust, that it may cover the bottome of this coffin, and put therein with their mouthes downeward eyther golden rayne, or Serpents, or both; also starres or petards: you must put some gunpowder dust among these; when you have filled the coffin with these or such like, cover the top of it with a peece of paper, and paste upon that a picked crowned paper, balast it with a rod, and it is finished; the Figure followeth.

How to make Fiends, or fearefull apparitions.

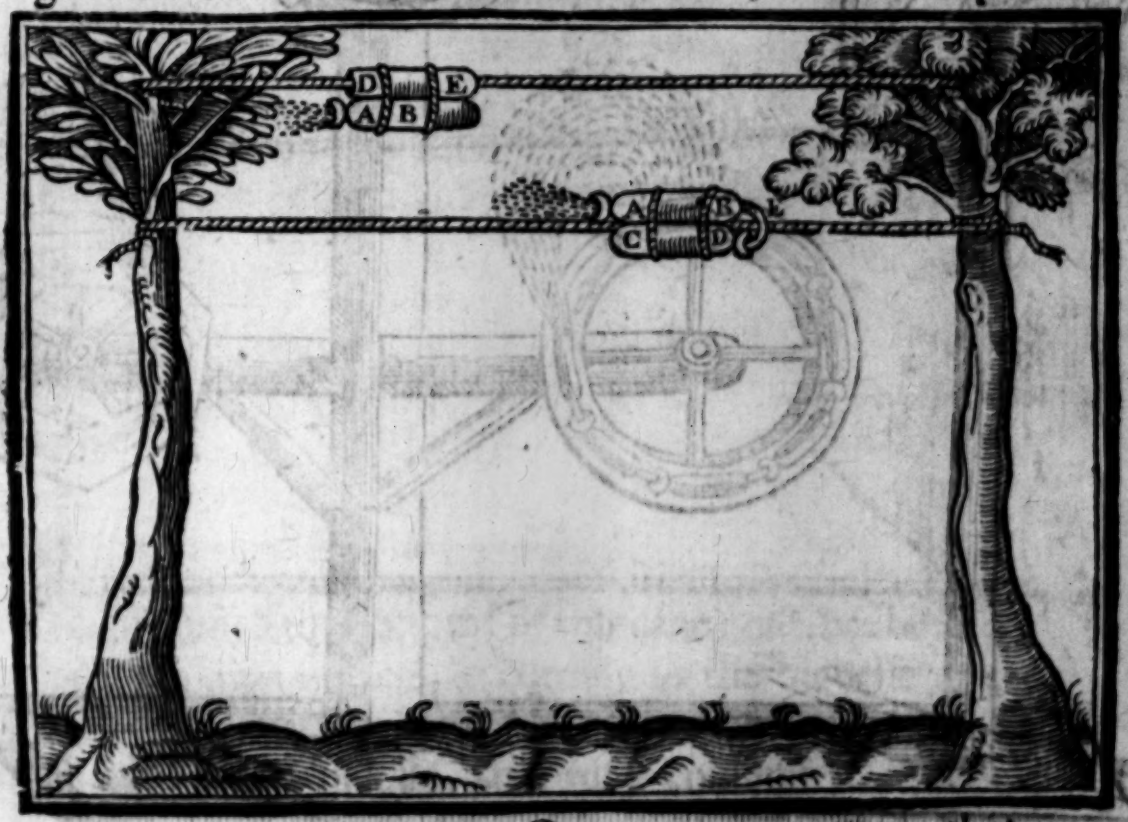
THeſe muſt be made of the compoſitions for Starres, wrought upon cotten weeke dipped in *aqua vitæ*, wherein camphire hath beene diſſolved, and after what faſhions your fancy doth moſt affect.

How to make fire Boxes.

YOu muſt make the coffins for fire Boxes of paſte-board, rowled upon a Former, of what bigneſſe you liſt; then binde them about with packthread, and glew over the cords; alſo glew bottoms unto them, which muſt be pierced with a bodkin to prime them at. In theſe boxes you may put golden raine, ſtars, ſerpents, petrars, fiends, divels. The tops of theſe fire boxes muſt bee covered with paper as the compound Rockets. Note that you muſt ſtrew gunpowder duſt a pretty thickneſſe on the bottom of the fire boxes, and prime the hole at the bottom with prepared ſtouple.

How to make Swevels.

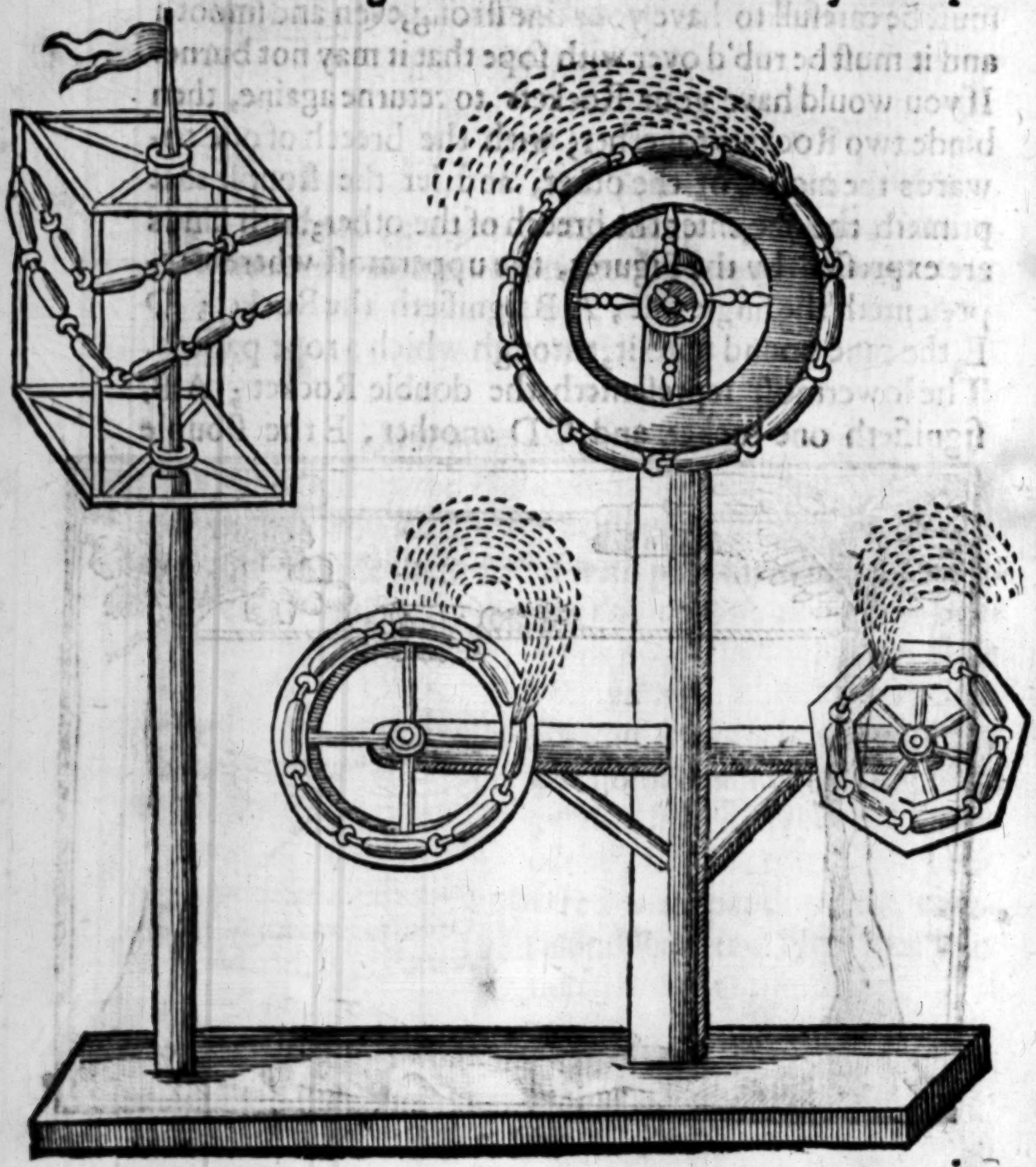
SWevels are nothing else but Rockets, having in stead of a rod (to ballast them) a little cane bound fast unto them, where thorow the rope passeth. Note that you must be carefull to have your line strong, even and smooth and it must be rub'd over with sope that it may not burne. If you would have your Rockets to returne againe, then binde two Rockets together, with the breech of one towards the mouth of the other, and let the stouple that primeth the one, enter the breech of the other; both kinds are expressed by the Figures, the uppermost whereof representeth the single one; A B signifieth the Rocket; D E, the cane bound unto it, through which a rope passeth. The lowermost representeth the double Rocket; A B, signifieth one rocket, and C D another, E the stouple



that primeth the one, and entreth the breech of the other; the cane that the rope paſſeth thorow is ſuppoſed to bee behinde the two rockets.

How to make Gironels, or fire Wheeles.

The making of fire wheeles conſiſteth onely in the pla-

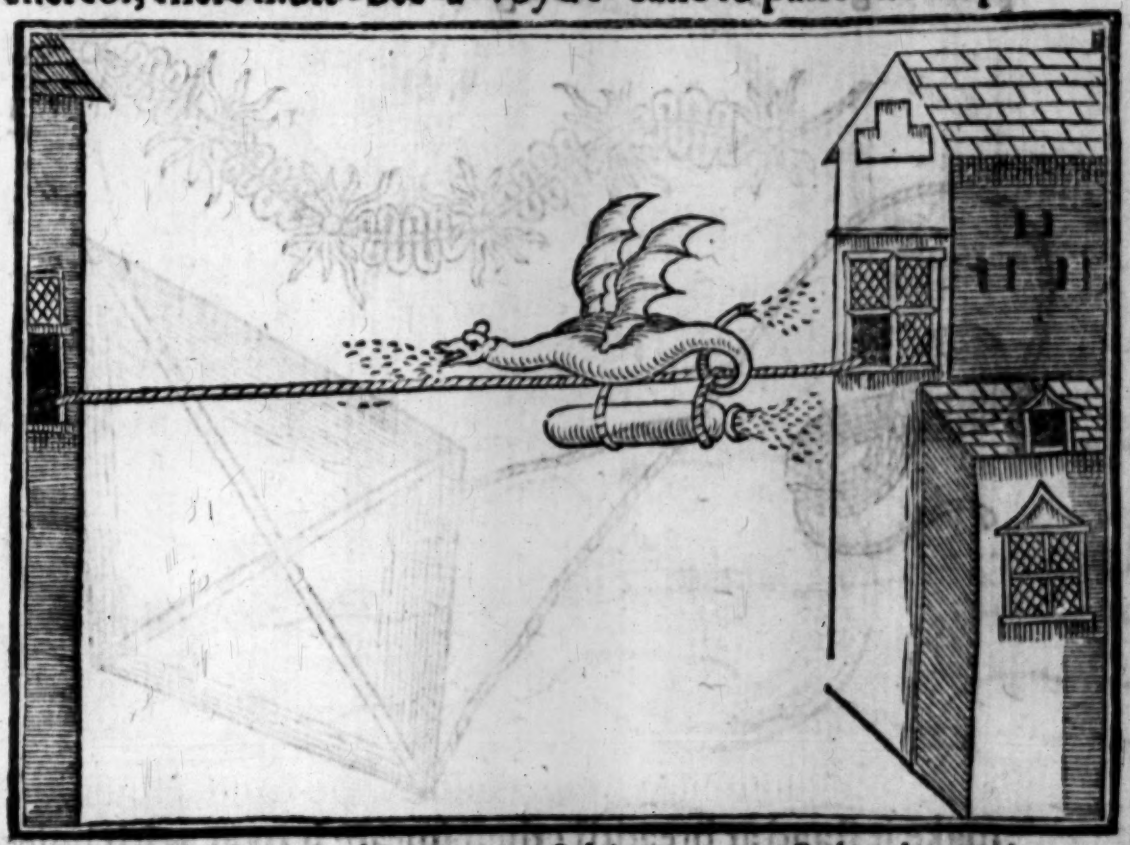


cing

cing of Rockets, with the mouth of one towards the tayle of another, round about certaine moveable wheels; wherfore I thinke it ſufficient only to deſcribe the diverſity of their faſhions.

How to make flying Dragons.

THe flying Dragon is ſomewhat troubleſome to compoſe; it muſt be made eyther of dry and light wood, or Crooked-lane plates, or of thin whalebones covered with Muſcovie glaſſe, and painted over. In the body thereof, there muſt bee a voyde cane to paſſe the rope

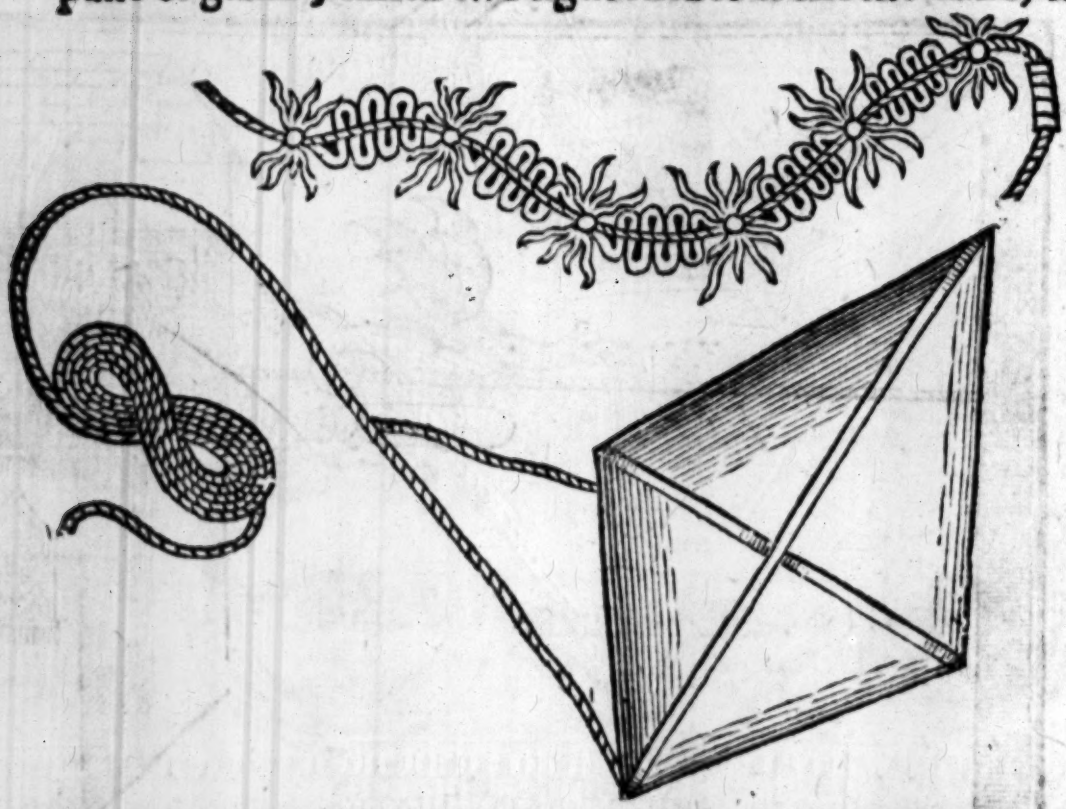


through; unto the bottome of this cane muſt bee bound one or two large rockets, according as the bigneſſe and weight of the Dragon ſhall require; the body muſt bee filled with divers petrars, that may conſume it, and a

ſparkling receipt muſt be ſo diſpoſed upon it, that beeing fired, it may burne both at the mouth and at the tayle thereof; then hang the wings on in ſuch wiſe, that they may ſhake as the Dragon runnes along the line; you may diſpoſe divers ſmall ſerpents in the wings; marke the Figure.

How to make fire Drakes.

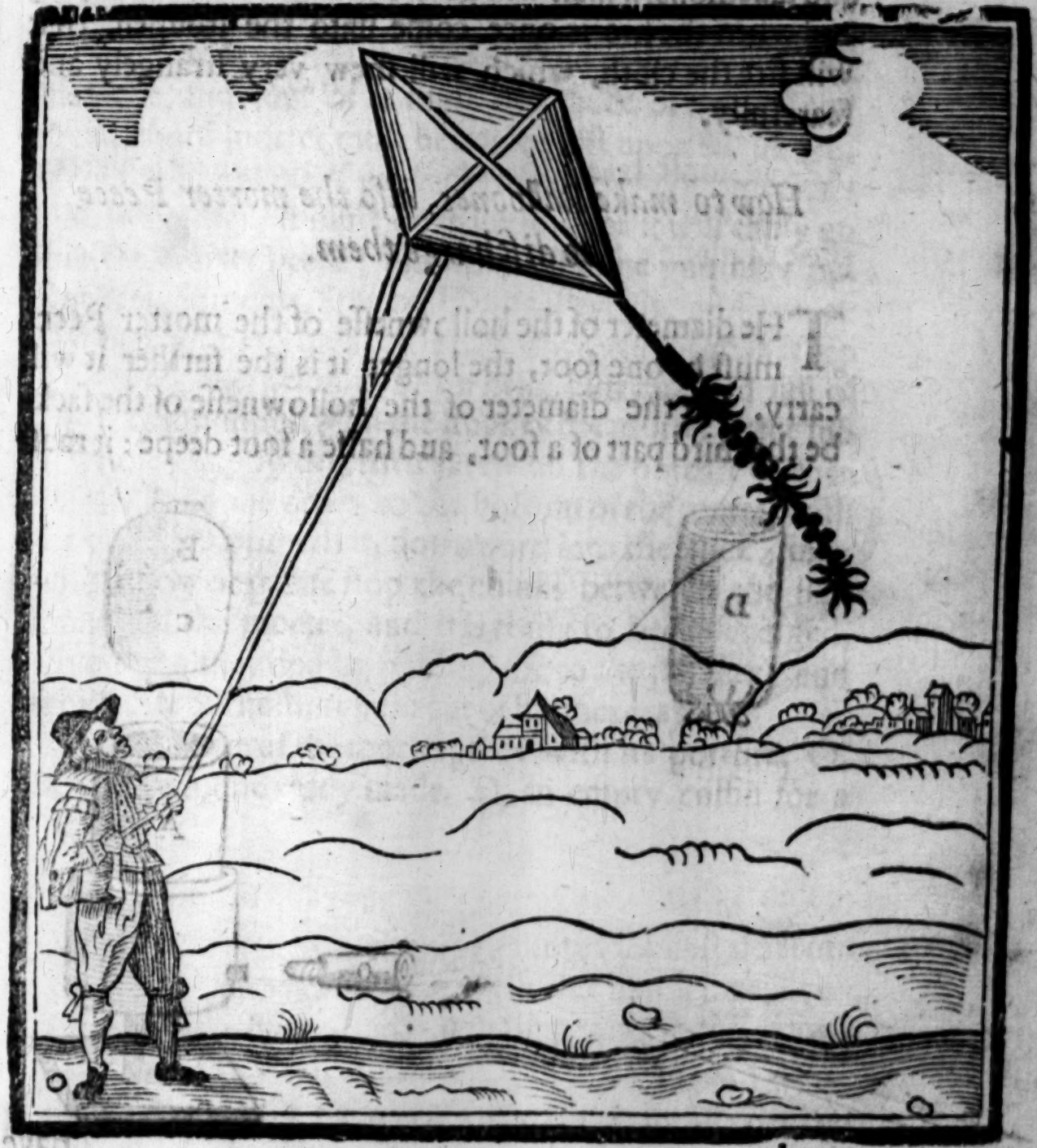
YOu muſt take a peece of linnen cloth of a yard or more in length; it muſt bee cut after the forme of a pane of glaſſe; faſten two light ſtickes croſſe the ſame, to



make it ſtand at breadth; then ſmeare it over with linſeed oyle, and liquid varniſh tempered together, or elſe wet it with oyle of peter, and unto the longeſt corner faſten a match prepared with ſaltpeter water (as I have taught before) upon which you may faſten divers crackers, or

Sauciſ-

Sauciſſons; betwixt every of which, binde a knot of paper ſhavings, which will make it flye the better; within a quarter of a yard of the cloth, let there bee bound a peece of prepared ſtoupell, the one end whereof, let touch the cloth, and the other enter into the end of a Sauciſſon:

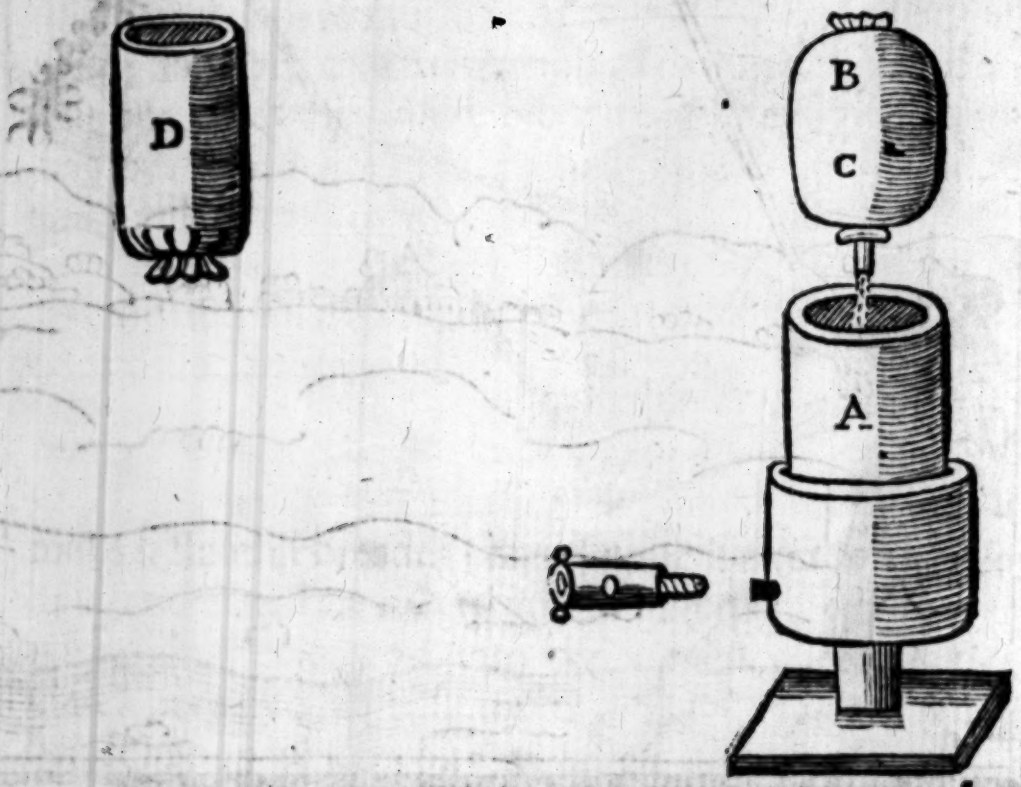


then

then tie a ſmall rope of length ſufficient to rayſe it unto what heighth you ſhall deſire, and to guide it withall: then fire the match, and rayſe it againſt the winde in an open field; and as the match burneth, it will fire the crackers, and ſauciſſons, which will give divers blowes in the ayre; and when the fire is once come unto the ſtoupell, that will fire the cloth, which will ſhew very ſtrangely and fearefully.

How to make Balloones, alſo the morter Peece to diſcharge them.

THe diameter of the hollowneſſe of the morter Peece muſt be one foot, the longer it is the further it will carry. Let the diameter of the hollowneſſe of the ſacke be the third part of a foot, and halfe a foot deepe: it muſt



have

have a ſquare foot, and a portfire to ſtrew in the bottome of the ſacke on the ſide of it; this portfire is to bee made like a cane about three inches long, and have a bottome ſodered unto the inſide of the skrew, which bottom muſt be pierced with a ſmall touch hole. This morter peece may bee made of iron, red copper, or for a need with paſtbord, armed with cord, and glewed over, but the ſacke, and foot of it muſt bee made of wood, and the paſtbord morter muſt be nayled faſt upon it. A Balloone muſt be made of canvaſſe rowled eight or nine times upon a Former, it muſt be made ſo, that it will eaſily go into the morter peece; into this Balloone you may put Rockets, Serpents, Starres, Fiends, Petards, and one or two Sauciſſons to breake the Balloone; then choak it up with cord, and prime it with a little cane rammed full of a ſlow compoſition; fill the ſtock of the morter peece full of whole gunpowder, then skrew on the portfire O, then put the Balloone down to the bottom of the morter with the cane that primeth it, downward into the ſtock; then with tallow or greaſe ſtop the chinks betweene the Balloone and the morter, and it is ready to bee diſcharged, which you may doe by putting fire to the portfire, and while that burneth, retreat out of harmes way.

A, the figure of the morterpeece with its portfire. O, B, C, a Balloone ready made. D, an empty coffin for a Balloone.

Of Fire-works for the Earth.

How to make Rockets for the Earth.

THe moulds for these Rockets for the earth are not made like those for the ayre, because that it is required that these should last longer, and have a more gentle motion: observe therefore the following directions for the making of them, which may serve for all occasions, without any alteration for bigger or lesser. Let the Diameter of their hollownesse bee halfe an inch, let their hollownesse be five or sixe inches long, let the rowler for to rowle the coffins on, bee the third pat of an inch thicke, and let the rammer to charge it be a thought lesse, let the breech bee three quarters of an inch long, and let the breech enter halfe an inch into the mould, then fill it with the composition proper for it, observing those rules in the ramming it, as you did in ramming rockets for the ayre; when you have filled it within an inch of the top of the mould, double downe a quarter of the coffin, beating it with three or foure strokes of the mallet; then with a bodkin pierce it in two or three places, and then put in the quantity of a pistoll charge of whole gunpowder, then double downe the halfe of the coffin, giving it a gentle blow or two with the mallet, and with a strong packthred choak the rest of the coffin, and what remaineth after the coffin is choaked, cut it off, and it is made.

How to make Crackers.

IT is well knowne that every boy can make these, therefore I think it will be but labour lost, to bestow time to

describe

deſcribe their making: onely thus much, if you would make a Cracker to give forty, fifty, a hundred, or two hundred blowes, one after another, then binde ſo many Crackers upon a ſtick, ſo that the end of the one may joyne to the mouth of the other.

How to make Trunkes.

THeſe you may make of paſtebord, paper or wood, and of what bigneſſe and length you pleaſe, and ram them full of the compoſition of Rockets for the earth; if you would have them to change colour, then alter the compoſition; that is, put in two or three ſpoonfuls of the compoſition of Rockets for the water, and ramme that in, then put in two or three ſpoonfuls of the compoſition of Rockets for the ayre, and ramme that in, then put in two or three ſpoonfuls of gunpowder duſt, and ramme that in, doe ſo till you have quite filled it, then tye a bottome of leather upon it, and pierce it and prime it with ſtoupell; after the ſame manner may you make lanternes and lights.

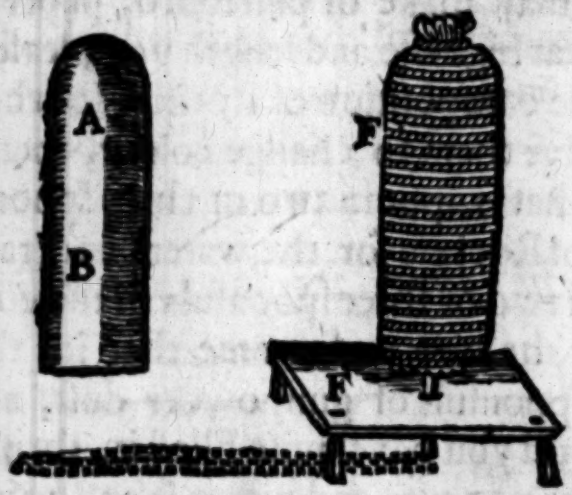
How to make tumbling balls.

MAke a ball of canvas, and faſten in it a double Rocket for the earth; you may ſtuffe the reſt of the ball with a ſlow compoſition of two parts, charcoale duſt, and one part of gunpowder duſt, mingled together, and put divers petrards amongſt it.

How to make Sauciſſons.

SAuciſſons are of two ſorts, eyther to be placed upon a frame, or ſuch like, and ſo to bee diſcharged with a

trayne of gunpowder, or elſe to be diſcharged out of the morter-peece. The ſtanding Sauciſſon is thus made; you muſt roll paper or canvas, nine or ten times upon a roller as A, B, and choake the one end of it; fill it then with whole gunpowder, and then choake the other end alſo, then cover all the Sauciſſon with cord, and glew it over; then pierce one end of it, and prime it with a quill filled



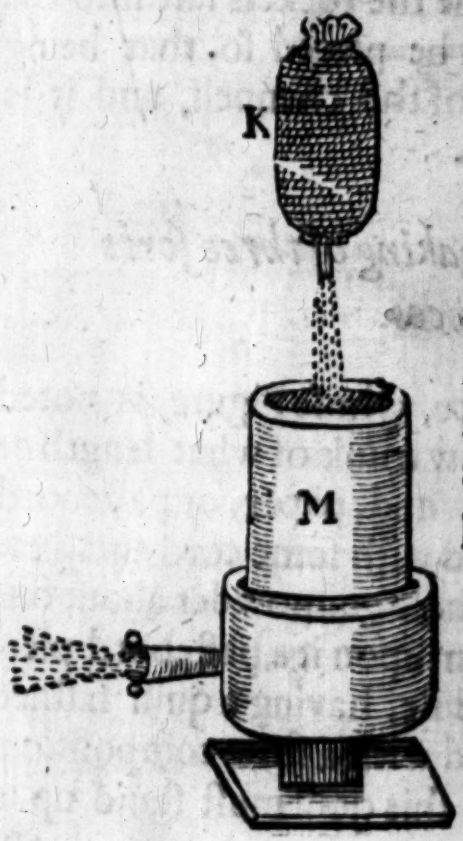
with gunpowder duſt; place it upon a forme having a hole for the quill to paſſe thorow; then fire it by a traine of gunpowder layd under the frame, it will give a report like a Canon: marke the Figure F F.

How to make Chambers.

TAke a Rocket caſe of what ſize you ſhall thinke fitting, according unto the report you would have it give; choake one end of it cloſe, and put it into a Former without a broach; then fill it one inch and a half or more (as you think fit) with whole gunpowder; then drive a bottom of leather hard into it, this bottom of leather

ther muſt be pierced with a ſmall hole in the middle, with a hot iron, or elſe it will be apt to cloſe againe. Fill then the other part of the coffin with a ſlow compoſition, up to the top, then take it out and binde 6. or 7. times about it a ſtrong packthred in that place where the bottom of leather is, and it is made: you may binde divers of theſe on a row upon a frame rayle or ſuch like, and put fire to their open ends, and they will burne ſlowly untill they come to the bottom of leather, and then each will give a report or blow one after another orderly, as you gave fire unto them. And theſe are uſually called Chambers, but more properly Sauciſſous.

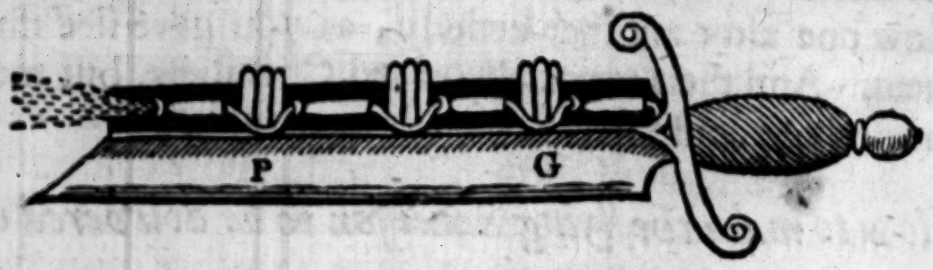
How to make the flying Sauciſſon to be delivered out of the morter peece.



MAke a coffin for this, as you did for the former; firſt, fill it almoſt with whole gunpowder, then put upon that gunpowder duſt, which you muſt ramme hard into the coffin, ſo that it may be one finger thick; then choak it cloſe, and arme, and prime it as you did the former. It is repreſented by the Figure K M.

How to make a fire Sword.

YOu must make a Sword of wood, having a deep channel in the backe of it, wherein place first a Rocket for the ground; then two or three Serpents upright; (with their mouthes inward) let the stouple that primeth the Rocket, come under the mouth of the Serpents, so that being kindled, it may set them on fire, and enter the breech of the next rocket, so fill the channell quite full



with rockets and serpents, binde the rockets fast into the channell, but the serpents must be placed so, that being once fired, they may flye out of the channell, and it is made: marke the Figure G, P.

The description and making of three sorts of Fire-lances.

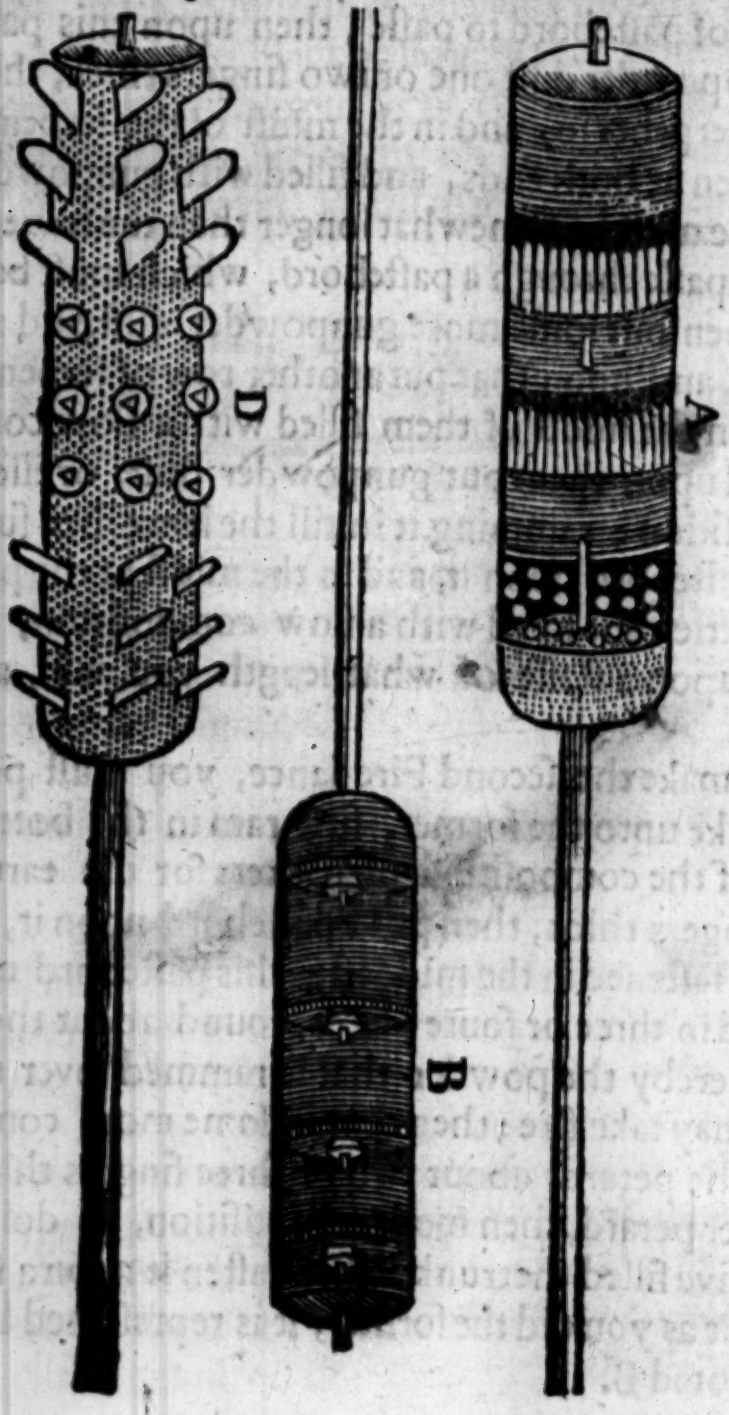
TO make the first Fire-lance, whose Figure is noted A, you must make a hollow trunk of what length or bignesse you please, eyther of wood, paper, or pastebord rowled on a rowler, and armed with some cord and glew first put into the bottom of whole gunpowder about one or two fingers thick, then ram upon it a pastebord pierced with a little hole in the middle, having a quill fastned in it, which quill must be filled with a slow composition, or else with gunpowder dust: this quill must stand up in the

the Lance two or three inches; then fill the coffin up to the top of the ſaid quill with ſtarres, and ſtrew among the ſtarres ſome gunpowder duſt, then put paſtebord over them, having a hole for the quill faſtned in the former bottom of paſtebord to paſſe; then upon this paſtebord ram gunpowder duſt one or two fingers thick, then put a row of ſerpents in, and in the midſt of the ſerpents put a cane open at both ends, and filled with gunpowder duſt; this cane muſt be ſomewhat longer than the ſerpents, and it muſt paſſe through a paſtebord, which muſt bee put over: then put ſome more gunpowder duſt, and ram it in upon it, and upon that put another row of ſerpents, with a cane in the midſt of them filled with a ſlow compoſition, and upon them put gunpowder duſt, or elſe a ſlow compoſition; ramming it in till the lance bee full; then put a paſtebord upon it, and in the midſt of the paſtebord put a little cane filled with a ſlow compoſition, then faſten it upon a ſtaffe of what length you will, and it is made.

To make the ſecond Fire-lance, you muſt prepare a trunk like unto the former, firſt ram in the bottom of it ſome of the compoſition of rockets for the earth about two fingers thick, then put a paſtebord upon it, having a petard faſtened in the middeſt; this paſtebord muſt bee pierced in three or foure places, round about the petard, that thereby the powder that is rammed over the paſtebord may take fire; then ram in ſome more compoſition upon the petard, about two or three fingers thick, then another petard, then more compoſition, ſo doing untill you have filled the trunk: then faſten it upon a ſtaffe, and prime it as you did the former, it is repreſented by the Figure noted B.

To

To make the third Fire-lance you must have a trunke also, which must be rammed full of a slow composition, of two parts charcoale dust, and one part gunpowder dust well mixed, prime it as the former, then bore divers



holes

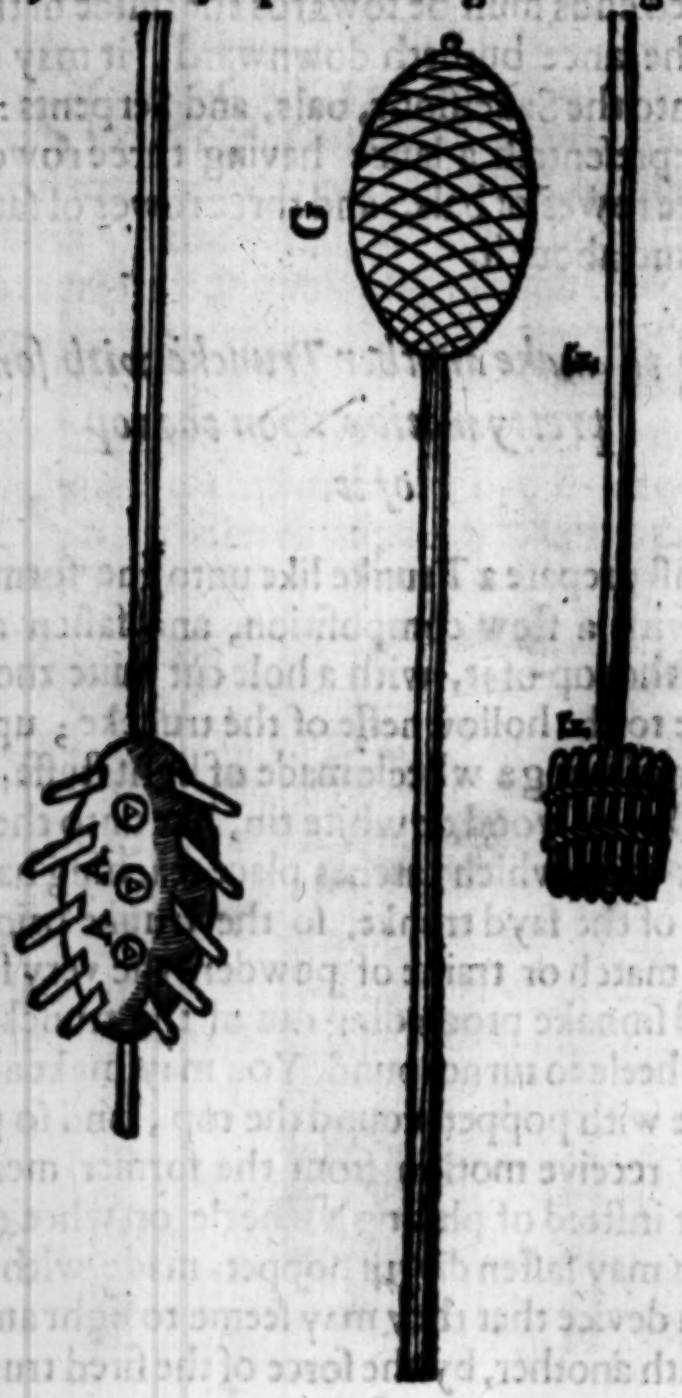
holes round about it, from the top to the bottom, into every of which holes glew a sauciſſon, or a ſerpent, or a little ball filled with gunpowder duſt, and having a petard in the middle: eyther of theſe muſt bee well primed, and their primed ends muſt be towards the inſide of the lance, ſo that as the lance burneth downward, it may orderly give fire unto the Sauciſſons, bals, and Serpents: the Figure D repreſenteth a lance having three rowes of ſerpents, three rowes of bals, and three rowes of ſauciſſons, faſtned round about it.

How to make another Truncke with ſome pretty motion upon the top of it.

YOu muſt prepare a Trunke like unto the former, and fill it with a ſlow compoſition, and faſten a ſquare bord upon the top of it, with a hole cut quite thorow it, anſwerable to the hollowneſſe of the truncke; upon this bord you may hang a wheele made of light ſtuffe, having divers catches of wood or white tin, like unto the wheele of a Water-mill, which catches place reaching halfe over the mouth of the ſayd trunke, ſo the trunke being fired either by a match or traine of powder, the very force of the fire and ſmoake proceeding out of the truncke, will cauſe the wheele to turne round. You may make alſo another wheele with poppets round the top, and ſo place it that it may receive motion from the former mentioned wheele; or inſteed of placing a wheele or wheeles upon the top you may faſten divers poppets made with joynts after ſuch a device that they may ſeeme to fight and combate one with another, by the force of the fired truncke.

The Deſcription and making of two ſorts of Fire-clubs.

TO make the firſt, you muſt make an ovall ball of paſte-bord, canvaſſe, or parchment glewed together, which



you

you muſt firſt fill with a ſlow compoſition, ram it in, and then bore divers holes round about it, and put therein ſerpents, fire bals, or what you will: faſten it upon a ſtaffe, and prime it in the top with a cane filled with a ſlow compoſition: this is repreſented by the Figure A A.

To make the ſecond you muſt fill divers canes open at both ends (and of a foot long, or more, or leſſe, as you think fit) with a ſlow compoſition, and binde them upon a ſtaffe of foure or five foot long; prime them ſo that one being ended, another may begin: you may prime them with a ſtouple or match (prepared as before) make an Oſier basket about it with a hole in the very top to fire it by, and it is done.

The Figure F F, repreſenteth the ſtaffe, with the canes bound upon it. The Figure marked G, repreſenteth the ſtaffe having a basket wrought over it.

How to make a Fire Target.

MAke a Target of Oſier twigs or elſe of light wood, and binde upon it divers canes filled with a very ſlow compoſition: the canes muſt bee open at both ends, and primed with ſtouple, that one may give fire unto another: in the midſt of all you may ſet up a large Cane alſo, if you pleaſe, which you may fill with the ſame compoſition as you did the others: Marke the Figure L, M, N, O.

Of Fire-workes for the Water.

How to make Rockets for the Water.

THe diameter of hollowneſſe of the mould for Rockets that ſwim on the water, muſt be one inch, and eight inches long: let the breech enter into the body of the Rocket one inch, and it muſt have no broach at all in it. Let the diameter of the thickneſſe of the Rowler be three quarters of an inch, the rammer muſt be a thought leſſer: then ram it full of the compoſition of Rockets for the water; joyne to the upper end of it a Sauciſſon: then cover it all over with melted pitch, roſin, wax, or tallow, to the end that the water may not ſpoyle the coffins; and to make it float along the water, binde a rod about two foot long, as you did unto the rockets for the ayre: now if you would have the rocket to change his actions, (that is, to

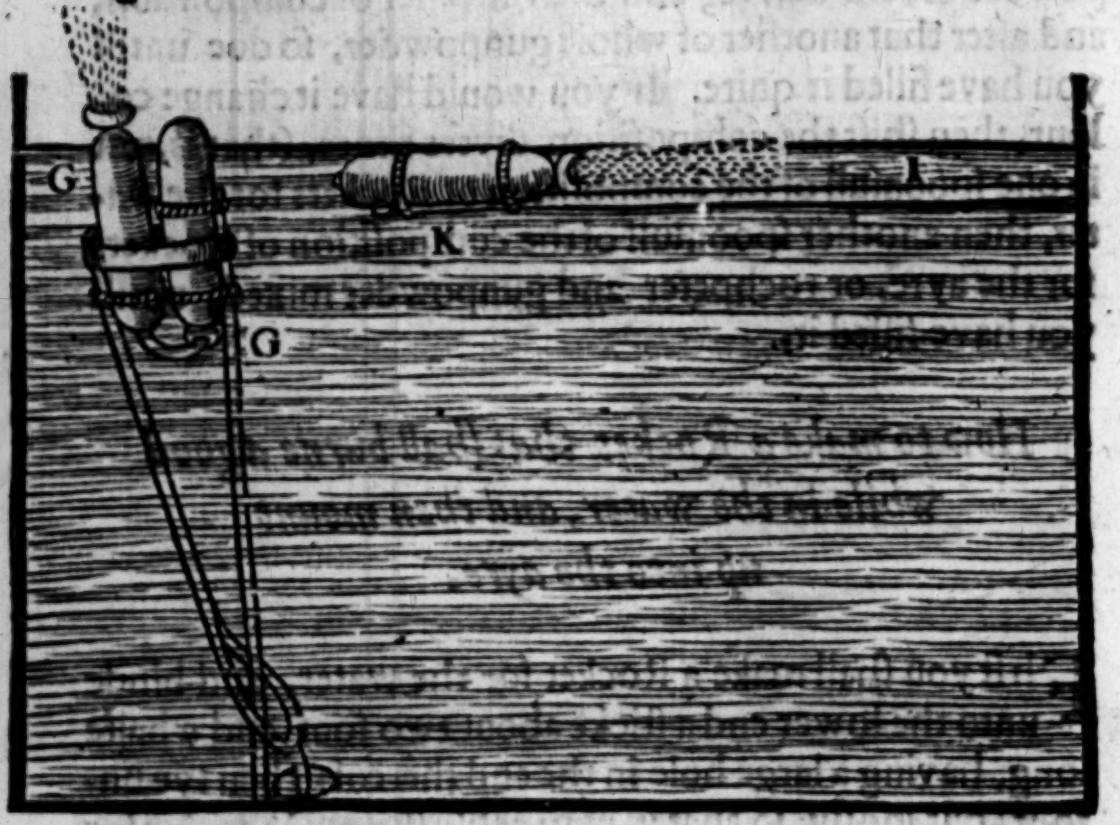
ſwim

ſwim one while above the water, and one while under the water) then put into it in the filling, one ſpoonfull of compoſition, and ram that in; then one ſpoonefull of whole powder & ram that in; and then another of compoſition, and after that another of whole gunpowder, ſo doe untill you have filled it quite. If you would have it change colour, then ſhift the compoſition divers times, (that is, put in one ſpoonfull of the compoſition of Rockets for the water, then another ſpoonfull of the compoſition of Rockets for the ayre, or rochpeter and gunpowder mixed) untill you have filled it.

How to make a Rocket that ſhall burne a good while in the water, and then mount up into the ayre.

FIrſt you ſhall make a Rocket for the water, and binde unto the lower end a ſticke about two foot and a halfe long, having a large hole in the end thereof: then tye unto it (but looſly, ſo that it may eaſily ſlip out) a rocket for the ayre, and let the ſtouple that primeth for the rocket for the ayre, enter into the breech of the water rocket, then let the end of the rod of the rocket for the ayre enter into the hole of the rod of the rocket for the water; beſmeare then both the rockets with tallow, greaſe, or wax, or any oyle colour, that the water may not ſpoyle the coffins of the Rockets; then hang a ſtone at the bottome of the ſtick that hath the hole in it, to make it ſink down into the water; then fire the water Rocket and caſt them into the water; the fired rocket will burne in the water, and being conſumed, will give fire unto the other rocket,

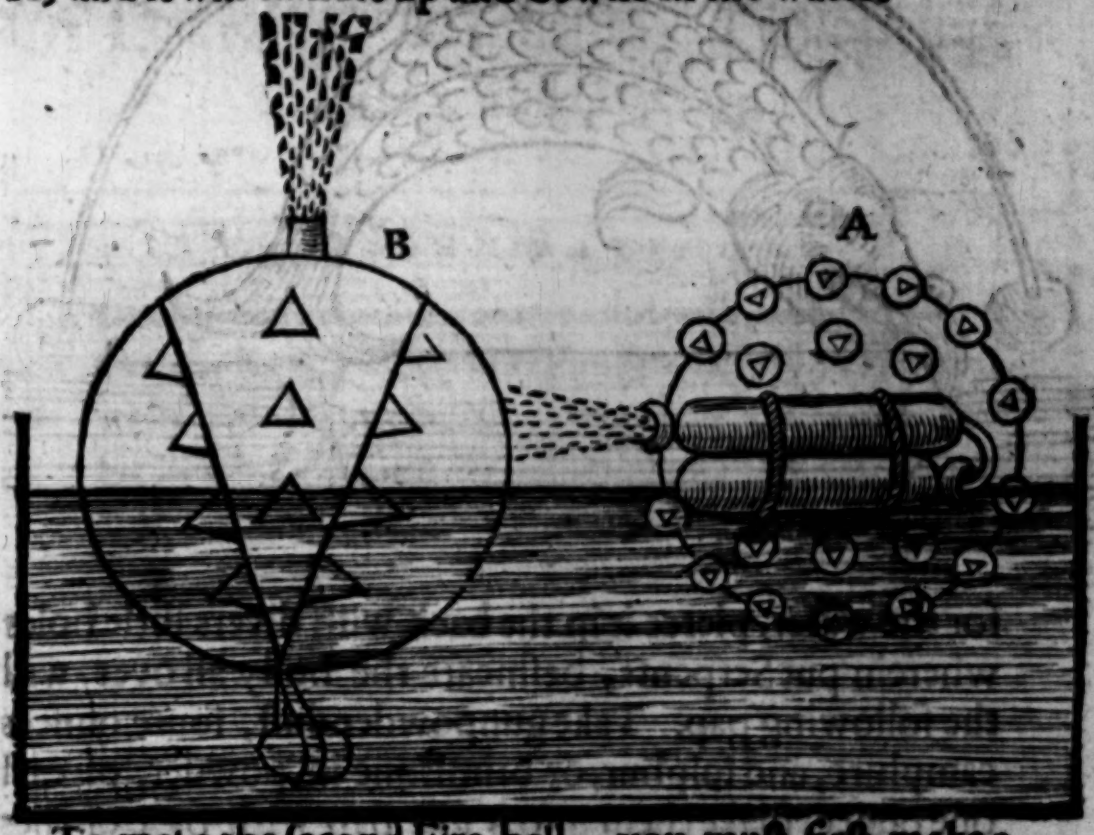
which being looſly tyed, will ſlip the bond, and mount up into the ayre. This is repreſented by the Figure G, G. The floating rocket mentioned before, is expreſſed by the Figure noted I, K.



The deſcription and making of two ſorts of Fire-bals for the water.

FOr to make the firſt, you muſt make a ball of Canvas, about the bigneſſe of a Foot-ball, or bigger if you pleaſe, and faſten in it a double Rocket for the water: if you will, alſo you may ſtuffe the reſt of the Ball with the compoſition that will burne under the water, and cut holes in the ſides, and therein faſten other bals, and petrards in them: then cover the ball over with Tallow, Pitch, or painting, except the place where the Rocket is primed, and

and it is done. It is represented by the Figure noted with A, and it will tumble up and downe in the water.

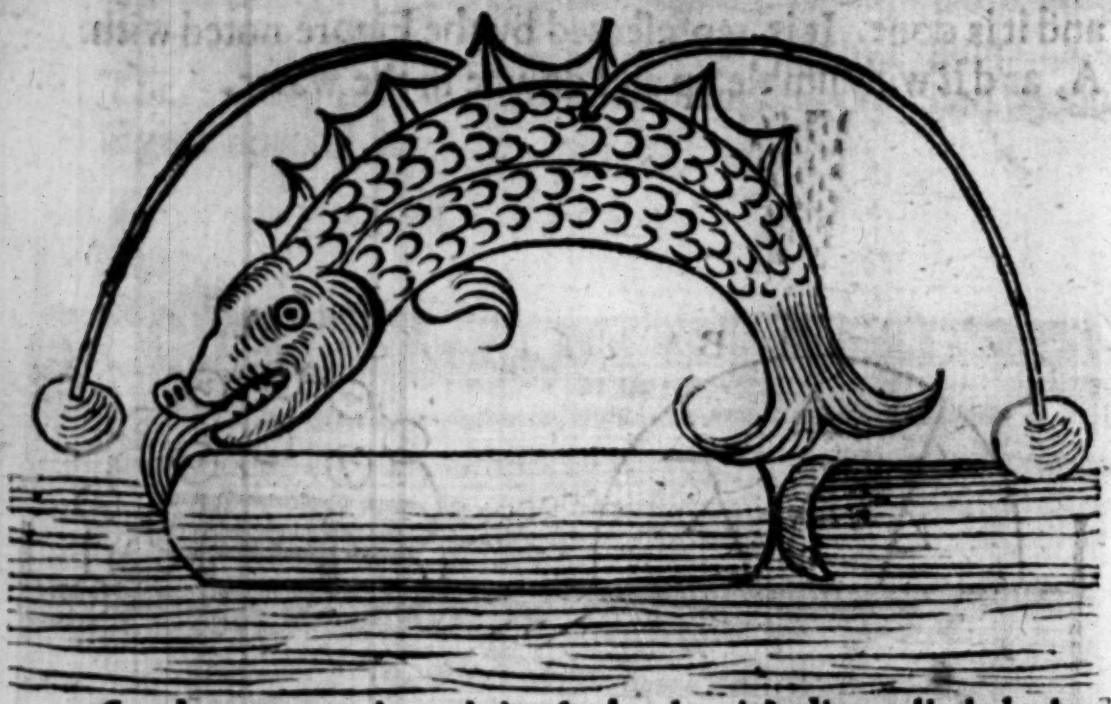


To make the second Fire-ball, you must first make a ball of Canvas, Pastebord, or such like, and cut a wide hole in the top of it, and place it in a channell of Tinne pierced in divers places: fill the channell with the compositions of Rockets for the water; against every hole thereof, place a petrard: cover it with a cover, pitch it over, and prime it, then ballast it with leade, or a stone, that the vent may burne upwards, and it is done. It is represented by the Figure B.

How to make a Dolphin.

YOu must make the body of it of Pastebord glued together, fill the body with the composition of Rockets

for



for the water, pierce it in the back with divers little holes, wherein put Serpents, beſmeare the body all over with the following pap. Take gunpowder duſt, foure ounces, camphire, and ſulphur, or brimſtone in powder, of each one ounce, make them into a ſoft pap with oyle of tiles, then binde unto it a large Rocket for the Water, which Rocket muſt be armed (as afore) that the water may not hurt it. then faſten it unto a peece of wood or cork cut like a ſharp boat, or ballaſt it with a wyre, having at each end a piece of lead of weight ſufficient, and it is done. Mark the Figure. After the ſame manner you may make Mermaides and other delightfull repreſentations.

I might have beene infinite in the deſcribing of ſuch like with Ships, Towres, Caſtles, Pyramides. But conſidering that it would but increaſe the price of the booke, and not better your underſtanding: ſince all conſiſt of the former workes, which are ſo plainly deſcribed, as that the moſt ignorant may eaſily conceive thereof. & (if any whit ingenuous) thence contrive others, of what faſhion they liſt.

FINIS.

THE THIRD BOOKE

Of Drawing, Limming, Colouring, Painting, and Graving.

By IOHN BATE.

LONDON,
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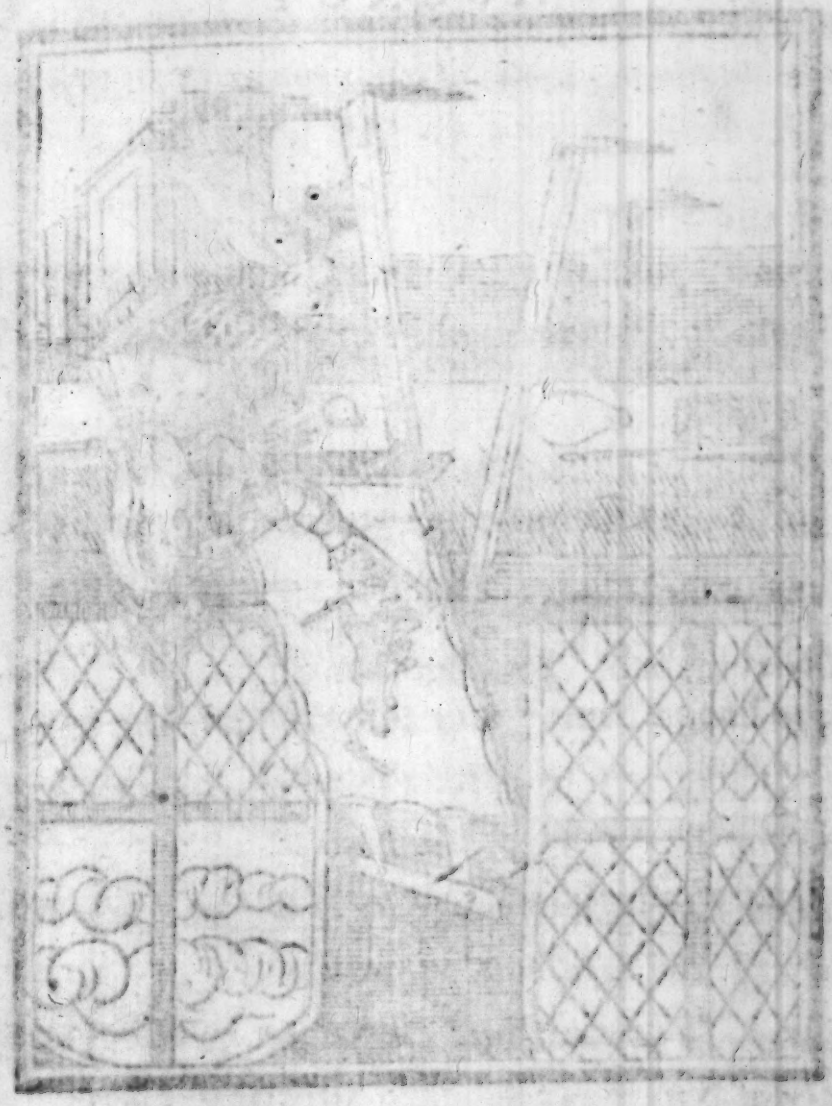
1635.



THE THIRD BOOKE

To the Reader.

The art of Drawing is in it ſelf moſt excellent, and worthy of commendations in whomſoever it is: yea it is an Art ſo neceſſary unto all ingenuous Artiſts, as that they can in no wiſe be without it. My ſelfe have often knowne it true, that the ſight of a good Figure is more unto an ingenuous perſon, than a whole Chapter of information: Wherefore I have according unto my knowledge and practiſe in the ſame, faithfully penned it, for ſuch as beare affection unto the Art, and are deſirous to be informed therein, adding thereunto ſuch inſtructions as I have received from ſuch Profeſſors as I have had familiarity with; alſo other collections that I have gathered frō time to time out of ſuch as have written of this ſubject. And for divers perſons that cannot attaine unto it, or are loth perhaps to beſtow any time to practiſe it, whereby they might come to a requiſite

perfection; for ſuch I have ſet downe certaine directions, and thoſe ſo facil and eaſie, that perſons altogether unskilfull may (having a patterne) work very well thereby.

Firſt, I will ſpeake of Drawing in generall.

Secondly, of waſhing Maps and other Pictures.

Thirdly, of Limming.

Fourthly, of painting in Oyle upon Cloth or Bord, and of diſtempering.

Fifthly, of painting upon Glaſſe, and annealing.

Farewell.

Of

Of Drawing.

DRawing is an imitation or lively repreſentation of things according unto their likeneſſe and ſimilitude: it is performed with the pen or with paſtils. In one that would be accounted abſolute and eminent in this moſt excellent Science, there is required; firſt, a good affection or love thereunto: Secondly, that hee have ſome knowledge in naturall Philoſophy; Thirdly, a copious and plentifull invention. From the two firſt, he himſelfe ſhall receive wonderfull delight and contentment in his practiſing: and the laſt, will make his worke pleaſing, and to be deſired of others.

Of neceſſary Implements, or Inſtruments for Drawing.

FIrſt, he muſt provide ſtore of drawing pens made of Ravens quils, good thicke and ſmooth paper: alſo, light coloured blew paper, and fine parchment, a flat thin braſſe Ruler, and a payre of compaſſes: alſo a Wing, and ſundry Plummets or paſtils to draw withall.

Of Plummets or Paſtils.

PLummets or Paſtils are of two ſorts; the one we may call naturall, becauſe they are ſuch as of themſelves being pointed, are made meet or fitting to draw withall: ſuch are theſe; Black lead, Black chalk, Charcoale ſplit, Red ſtone, White calk.

Others there are which we call artificiall, becauſe they are made by tempering ground colours artificially, and after forming them into little rowles, meet and convenient to draw withall.

The manner of making artificiall Paſtils or Plummets to draw withall.

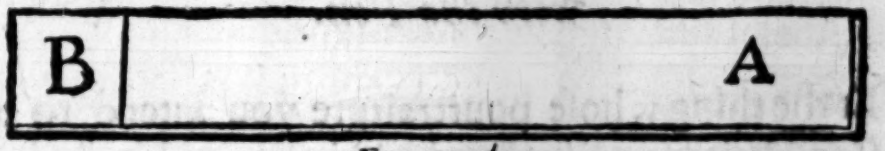
TAke a great Chalk ſtone, and make furrowes or concavities in it two or three inches long, and ſo wide that you may lay into each a quill. Then take a proportion of white chalk ground very fine, temper it with Ale or Wort, and a little new Milke, and ſo make Pap thereof: then powre it into the furrowes of the chalk: ſoone and in a ſhort time, you may take them out and rowle them up, or let them lye in the ſame untill they are quite dry, and then take them out and ſcrape them into a handſome forme.

You may temper Lake with burnt Alabaſter for a red.

Alabaſter burnt and Bice for a blew, and ſo for others; having regard to ſome colours that will binde over hard, which muſt have a little water put to them in their grinding.

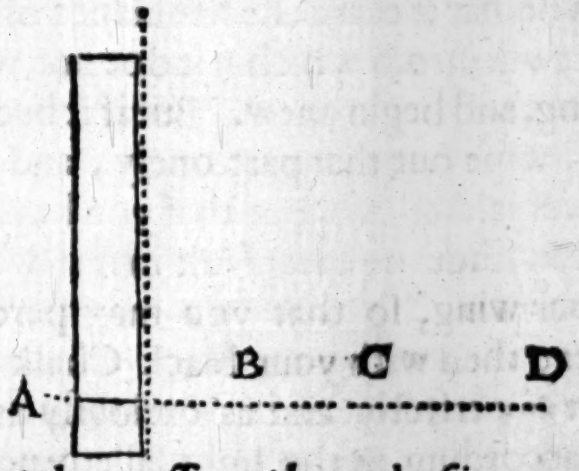
The practice of Drawing.

THe first practises of a Beginner, must be readily and quickly to draw with his pen, Circles, Ovals, Squares, Pyramids, Paralels, Diameters, and other Geometricall solid bodyes, for these will fit his hand for the performance of other bodyes, and unto these and such like, he may reduce all other workes whatsoever. You may in the beginning assist your selfe in the performance of these: as also try whether your operation bee done aright, by your ruler and compasse. Let the end of your ruler be marked with a crosse stroake athwart it. The Figure of the ruler followeth, and it is noted with the Letters B A, it will helpe you to draw Squares, Diameters, Paralels.



Example.

Let A B C D be a Line given, whereon to erect another line that they may both stand square; Lay but the



ruler so that the crosse at the end of it, may bee full upon the

the Line, then draw a Line by the ſide of the Ruler, and it is done.

Your compaſſes will ſerve to marke your diſtances aright, and to aſſiſt you in deſcribing Circles, Ovals: theſe I ſay may aſſiſt you, but you muſt endeavour to attaine to the performance of the ſame, without the helpe of theſe. Next, let him practice to draw Pots, Balles, Candleſtickes, Pillers, Houſes, and other ſuch like Figures, that come neareſt unto the former. Then to draw Leaves, Flowers, Slips, Flyes, and Creeping things; and Laſtly, becauſe it is the moſt difficult to draw men, foure footed beaſts, and other ſuch difficult workes.

Of the manner of Pourtraiting or Drawing with the Pen.

LEt the thing whoſe pourtraiture you intend to take, ſtand before you, ſo that the light be not hindred from falling upon it, and with a pointed peece of charcoale draw it rudely and lightly; which when you have done, conſider a while whether all the parts thereof are proportionable, and whether it carry the ſemblance of the thing whence you drew it; from which if it doe not, wipe it out with your Wing, and begin anew. But if it bee faulty in one part onely, wipe out that part onely, and draw it againe whenſoever it liketh you; or that you have ſo drawn it, that you can finde no great fault in it, wipe it over gently with your wing, ſo that you may perceive your former ſtroakes; then with your black Chalk or other paſtils, draw it as perfectly and as curiouſly as you can, and ſhadow it according as the light falleth upon it. If you draw upon blew paper, after that you have finiſhed your

your draught, you must wet your paper in faire water, and let it dry of it selfe, this will make the drawing hold fast on, which otherwise would easily be wiped off.

Observations.

1 ENdeavour alwayes to retaine in your imagination, the very Idæa or resemblãce of the thing you draw.

2 When you can draw ordinary things pretty well, then assay to draw more difficult; as the proportions of Mankind, and in them proceed by degrees: first, learne to draw the head, then the hands and feet, and lastly, the other shape of the body, proportionable thereunto.

3 Be not out of conceit with your works, although they give you not at the first contentment according unto your minde, for daily practice with a continued resolution and intention of the minde, must gaine the true proportion by little and little.

Of Drapery, or drawing Apparell and Cloths.

DRapery consisteth in the drawing or figuring of cloth, and garments, with their doublings and foldings shadowed accordingly.

The Rules for Draperie.

1 FIrst, you must draw the utmost lines of your garments, having spare places, where there is need of foldings.

2 Draw alwayes your greater folds first, which continue throughout the whole garment, from the skirt upward, and be sure that you let no one touch or crosse another.

3 Breake your greater folds into leſſe, not ſparing to ſhadow them, though they be never ſo ſmall, and that with a double or treble hatch, if ſo bee that they fall inward and from the light.

4 The cloſer the Garment ſits, the narrower you muſt make the folds.

5 Order your Garments ſo, that the folds thereof may fall one way according unto the motion of the ayre.

6 Fold not your Garments where they ought to ſit cloſe, and leave the formes of eminences appearing; as of the Breaſts, and Legs.

Of Diapering.

DIapering, is a paſſing or over-running your worke (after it is quite finiſhed) with branches or other worke.

The Rules for Diapering.

1 IF you Diaper upon folds, you muſt make your Worke to breake off accordingly.

2 You muſt have a care to continue the ſame Worke throughout the whole Garment.

3 You muſt ſet the faireſt in the moſt eminent and perſpicuous place.

4 You muſt cauſe your branches to run all upwards, elſe your Worke will be ridiculous.

Of Landskip.

LAndskip is the expreſſion of Land by Hils, and Mountaines, Rockes, Ruines, Rivers, Valleyes, and ſuch like.

The

The Rules for expreſſing of Landskip.

1 YOu muſt make a faire Horizon, expreſſing the Heavens more or leſſe over-caſt with Clouds; and if you expreſſe the Sun, make it riſing or ſetting behind ſome Hill or Mountaine, and then let all the light of the trees, be given thitherward, and your Clouds muſt be ſhadowed from the Sunne.

2 Never expreſſe the Moone or Starres, but upon neceſſity.

3 Be very carefull to leſſen your bodyes, proportionable to their diſtance, expreſſing them more faintly or fully, according as your Eye judgeth of them.

Of Emblem, or Empreſſe Worke.

Emblem or Empreſſe worke, is the moſt hard or difficult of all others, and the moſt to bee commended above all other workes: It is to imitate the face of Mankinde ſo neare after the life, as that not only the party in all likeneſſe both in favour and complexion, but alſo his beſt graces and countenance is moſt notably expreſt. This indeed ought not to be attempted, untill one were reaſonable good in Story worke, which you may in a reaſonable time attaine unto, by the imitation of good prints.

The comelineſſe of the face conſiſteth in three parts. Firſt, in the faire and beautifull colour and complexion. Secondly, in the good favour and proportion. Thirdly, in the grace of the countenance. The curious Drawer muſt watch, and as it were catch the lovely graces, witty ſmilings, & ſullen glances which paſſe ſodainly like lightning,

obſerving how in ſmiling the Eye changeth, and narroweth, holding the ſight juſt betweene the lids, as a Center; how the mouth extendeth a little both ends of the line, upwards; the Cheekes rayſe themſelves to the Eyesward; the Noſtrils play, and are more open; the veynes in the Temples appeare more, the necke commonly erecteth it ſelfe, the eye browes make ſtraight Arches, and the forehead caſteth it ſelfe, as it were, into a plaine. In likeſort, the countenances of wrath, feare, and ſorrow, have their ſeverall alterations.

The Drawer muſt make the eyes of his picture ſo like one another, as Nature doth; for in the Eye is the life of the picture. Be ſure that the circle of the ſight be perfectly round, for ſo much thereof as appeareth. The Center truly placed in the midſt thereof. The reflection of the ſight which appeareth as a white ſpeck, muſt bee placed accordingly unto the light.

The fartheſt Eye from the Drawer, muſt be a little higher than the hithermoſt, becauſe of the proſpective, if the Drawer ſit any higher than the party drawne; But if lower, then the fartheſt eye muſt be a little lower. If level, then to be of one height. So ſhall the worke by well placing and true doing of the Eye have great life; for of all the features in the face of a picture, the eyes give the moſt life, the Noſe the moſt favour, and the mouth the moſt likeneſſe; although likeneſſe be contayned in every part, even feature in the cheekes, chin, fore-head, with the compaſſe of the face, but principally and eſpecially in the mouth.

The Drawer muſt marke when the party removeth, though never ſo little, if in the ſuddaine he remove a great deale, then he may eaſily marke it, and recall him unto his

firſt

first line, but the little moving (if he perceive it not quickly) will leade him into a great errour.

In drawing after the life, sit not nearer than two yards from off the party, and sit as even of one height as possibly you may, but if the party you draw, bee a very tall person, let him sit a little above you, because men are commonly under him, and will not judge so of the picture, because they underview it. If the person you draw bee very low or a child, then use the like discretion in placing him somewhat lower than himselfe. If you draw from head to foot, let the party stand at the least *6.* yards from you, when you take the description of his whole stature; and so likewise for the stelling of your picture of what length soever, according unto the proportions of the face: let the party arise and stand, (for very few can sit so upright as they stand) whereby the Drawer oft times is greatly deceived, and the partie drawne disfigured. Stell not a Childe when you draw the hand, but when you espie a good grace in the hand, take it quickly, and pray them not to stand still, for commonly they give the hand a more unnaturall or affected grace.

First, draw the stroake for the fore-head, which must be done most exactly, because that according unto that scantling and proportion, must all the rest be drawne; as if the fore-head be so long, then from the forehead to the chin, must be twice so long; next draw the fartheſt eye; thirdly draw the nose, fourthly draw the neareſt eye, leaving the just length of an eye betweene it and the other; having continuall regard that the parties fartheſt eye, seem to your appearing to bee just so much distant from the fore-head stroake, as it was when you first began; if it be not, proceed no farther untill you have recovered, or

recalled him to his former place, then draw the mouth, next the chin, then finish the out line of the face; and lastly, the haire: having finished the head, draw the whole bodie proportionable thereunto.

Of Shadowing.

THe chiefest part of Drawing, consisteth in the true proportioning of a Picture, for the line sheweth all unto a good Iudgement. But the shadow without the line sheweth nothing: the line onely sheweth the countenance, but the line and shadow, sheweth the lively likenesse.

Shadowes best become great peeces, and such as are to be viewed a farre off.

To shadow sweetly, and round withall, is a far greater cunning, than to shadow hard and darke; for to round a worke, cannot be without some shadowes, but to shadow as it were not shadowed, is best of all. Everie thing must be done in its proper kinde.

Shadowes shew the effect or defect of the light, in the place where the picture was drawne.

Thus much for those that are contented to take some paines to attaine so noble a Science: Now there follow certaine directions for those that are unskilfull, and have not spare time sufficient to spend in the practice of the forementioned directions; yet are desirous upon occasions, and for certaine ends, to take the copie of some letters, prints, and pictures, that they oftentimes may meet withall. The which are so facile and easie, as that Children of but indifferent discretion, may performe the same.

How

How to take the perfect draught of any printed, or painted Picture.

TAke a ſheet of Venice (or in ſtead thereof) of the fineſt white paper that you can get: wet it all over with cleane ſallet oyle: then wipe the oyle off from the Paper, as cleane as you can, ſo that the paper may be dry, otherwiſe it will ſpoile a printed picture by the ſoaking thorow of the oyle: having thus prepared your paper, lay it upon any painted or printed picture, and you ſhall ſee the picture thorow the ſame more perfectly appearing, than thorow glaſſe, and ſo with a blacke lead pen, you may draw it over with eaſe, and better firſt with a ſoft charcoale, and then with a pen. After that you have thus drawne the picture upon the oiled paper, put it upon a ſheet of cleane white paper, and with a little ſticke pointed, or (which is better) with a feather taken out of a Swallowes wing: draw over the picture againe, and ſo you ſhall have the ſame very prettily and neatly drawne upon the white paper, which you may ſet out with colours, as ſhall be taught hereafter.

Another way.

HAving drawne the picture, firſt open the oiled paper, put it upon a ſheet of cleane white paper, and pricke over the ſame drawing, with a good big pin, then from the cleane ſheet, that is pricked, pounce it upon another: that is, take ſome ſmall coale, powder it fine, and wrap it in a piece of Tiffanie or ſuch like, and binde it up therein looſely, and clap it lightly over all the pricked lines by little & little, and afterwards draw it over again with a Pen or Pencill, or otherwiſe as you pleaſe.

Ano-

Another way.

TAke a ſheet of thin white paper, and rub it all over one ſide with black lead, or elſe with vermilion tempered with a little freſh Butter; then lay this coloured ſide upon a ſheet of cleane paper; then lay the Picture you would coppie out, upon the other ſide of the coloured paper, and with a ſmall pointed ſticke, or with a Swallowes feather, goe over all the ſtroakes of your picture, that you deſire, and then you ſhall have the ſtroakes drawne very prettily on your white paper.

Another way.

TAke a peece of a cleere Lanterne horne, and lay it upon your picture; then with a pen made of a Ravens quill, draw the ſtroake of your picture upon the Horne, and when it is drie, breath upon the horne twice or thrice and preſſe it hard upon a peece of cleane white paper, a little wetted; and the picture that you drew upon the horne, will ſticke faſt upon the paper.

Another way.

TAke a ſheet of white paper, rub it all over with freſh Butter, and dry it in by the fire, then rub one ſide of it all over with Lamper black lake, or any other colour finely ground, lay this paper upon a ſheet of faire paper, with the coloured ſide downwards; and upon it, lay the Picture you would copie out, and trace the ſtroakes over, with a feather of a Swallowes Wing, and you ſhall have your deſire.

Ano-

Another way very pretty and easie to be performed.

TAke some Lake, and grinde it fine, and temper it with Linseed oyle, and afterwards with a pen, draw with this mixture (instead of Inke) all the out streaks of any printed picture, also the muscles: then wet the contrary side of the picture, and presse it hard upon a sheete of cleane white paper, and it will leave behinde it all the streakes of the sayd Picture that you draw over.

Another way much like the former.

TAke Printers Blacking, grinde it fine, and temper it with faire Water, and with a pen dipt therein, draw over the master streakes and out lines of the Muscles: wet then a faire paper with a spunge, and clap the picture upon it, pressing it very hard thereupon, and you shall finde the streakes you drew, left upon the faire paper.

An easie way to lessen any picture: that is, to draw a picture from another, in a lesser compasse.

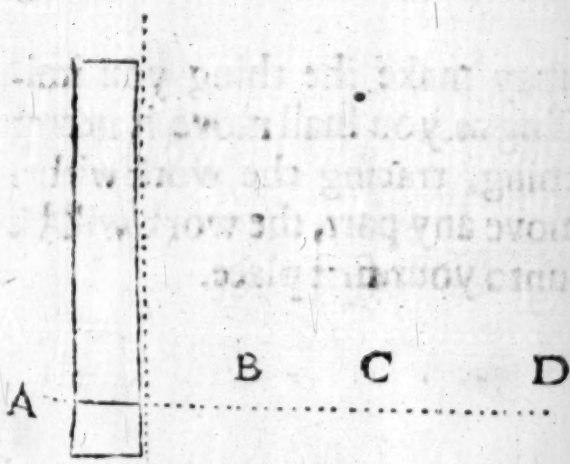
FIrst, with a Ruler, and a blacke lead plummet, draw a line at the very top: also another at the bottom paralell, or equally distant from the other: from the upper Line, let fall two perpendicular or plum lines even unto the lowermost Line, so those foure Lines will make a square: now you must divide this square into divers equal parts, with a paire of compasses, and draw Lines with a Ruler and black Lead plummet, quite over the picture: so

the leſſe lines will divide the picture into equall parts or ſquares, then take a faire paper, and make as many ſquares upon it, as there is in the picture: you may make them as little as you will, but be ſure that they are equall, and of juſt number with thoſe in the picture. Having thus croſſed your picture, and drawne over your faire paper into ſquares, take a black lead pen, and draw the picture by little and little, paſſing from ſquare unto ſquare, untill you

have finiſhed the whole: ſtill obſerving the order of the ſquares as they ſtand in either: then draw it over with a pen, in which ſecond drawing of it over, you may eaſily mend any fault: when it is dry, rub it over with the crum of white bread, and it will take off all the black lead ſtrokes, and your draught only will remain faire upon the paper or parchment.

The

The following figure noted B A ſignifieth a Ruler, which will aſſiſt you to croſſe your paper with ſquares. Example; let A B C D be one line, lay the Ruler ſo, that the croſſe over the end of the Ruler may lie full upon the line, then draw a line by the ſide of it, and ſo proceed, and with the aſſiſtance of a payre of compaſſes you may make as many ſquares as you liſt.

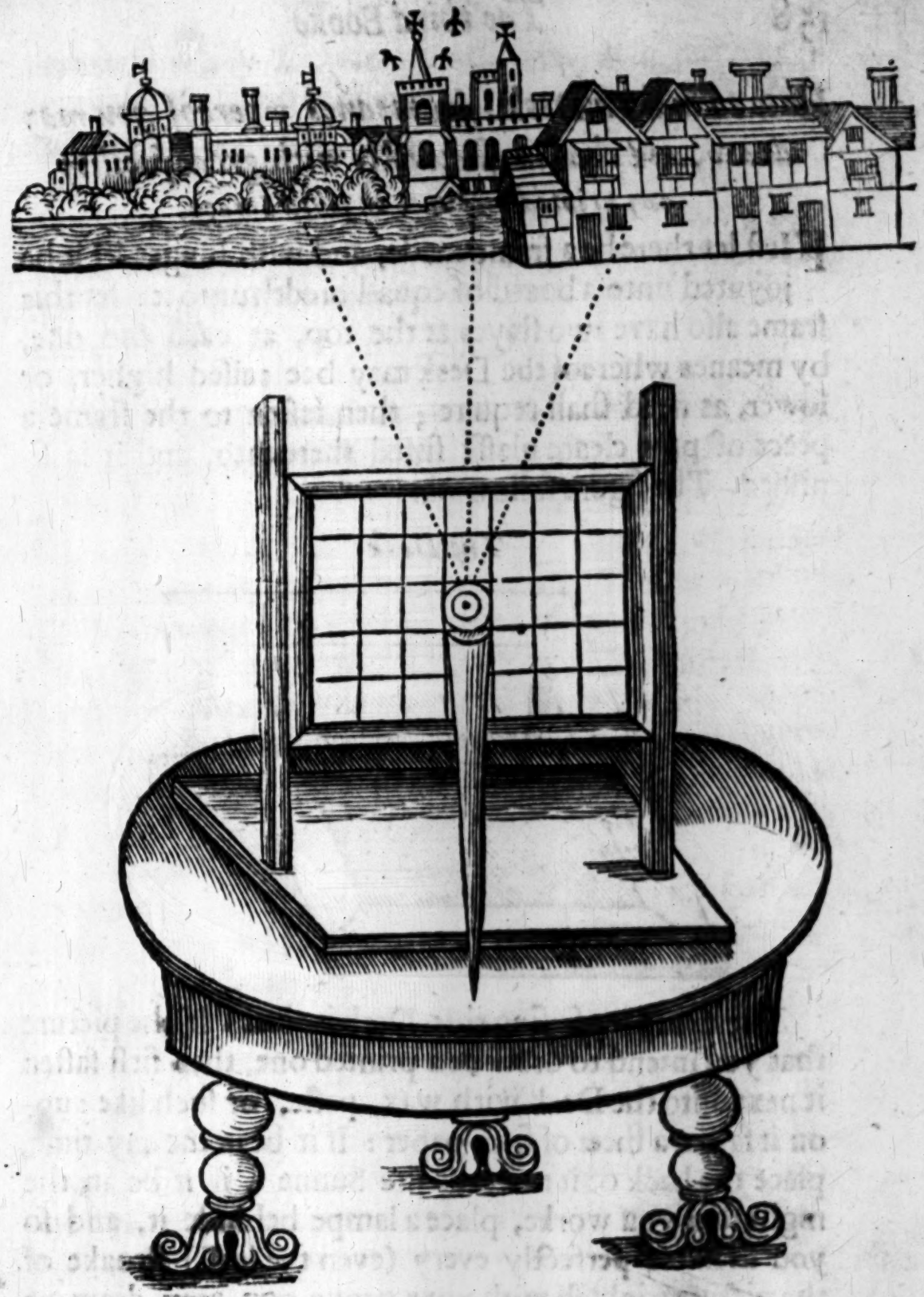


A very eaſie way to deſcribe a Towne, or Caſtle: being within the full ſight thereof.

FOr the effecting of this, you muſt have a frame made, and croſſed into equall ſquares with Lute ſtrings, and figured at the end of each ſtring: this frame muſt have a foot, wherein it muſt be made to be lifted higher or lower as occaſion ſerveth; alſo you muſt divide your paper that

you are to draw upon into ſo many equall ſquares as your frame containeth: having the like figures at the ends of each line that there is on the frame; before this frame muſt bee placed a ſtyle or bodkin having a little glaſſe on the top of it for to direct the ſight. Note, now that the neerer any thing commeth unto the center, the leſſer it appeareth: hence it is, that a Towne of a mile, or more long, or a huge great Caſtle, at a diſtance may bee comprehended, and that eaſily within the limits of ſo ſmall a frame; By the ſtile direct your ſight from one part to another, beginning at one ſquare, and proceeding through the reſt in order as they lie; marke well the following figure.

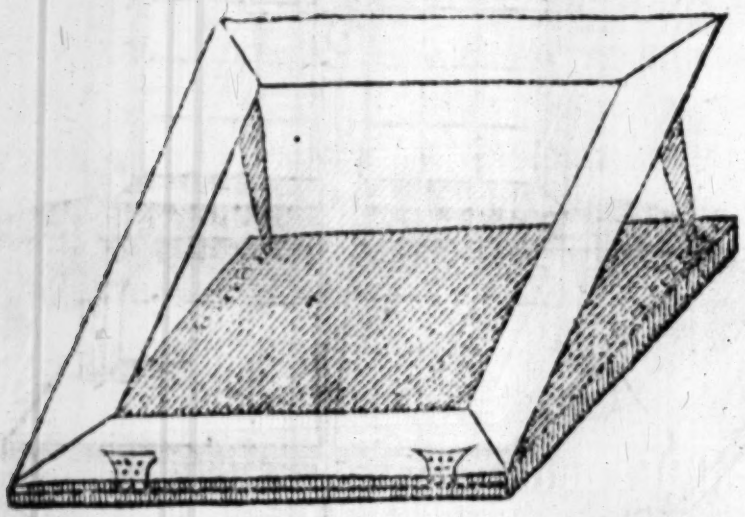
By which figure you may make the thing you imitate bigger or leſſer according as you ſhall move it neerer or farther off from the thing, tracing the work with a cole. Note, that if you move any part, the work will be falſe, except you returne unto your firſt place.



How to make a Desk: by meanes whereof you may draw, and that moſt exactly with great facility any printed picture, or ſollid Image.

FIrſt let there be a frame made, and with hinges let it be joynted unto a board of equall bredth unto it: let this frame alſo have two ſtayes at the top, at each end one, by meanes whereof the Desk may bee raiſed higher, or lower, as need ſhall require; then faſten to the frame a peece of pure cleare glaſſe fitted thereunto, and it is finiſhed. The figure followeth.

The Desk.



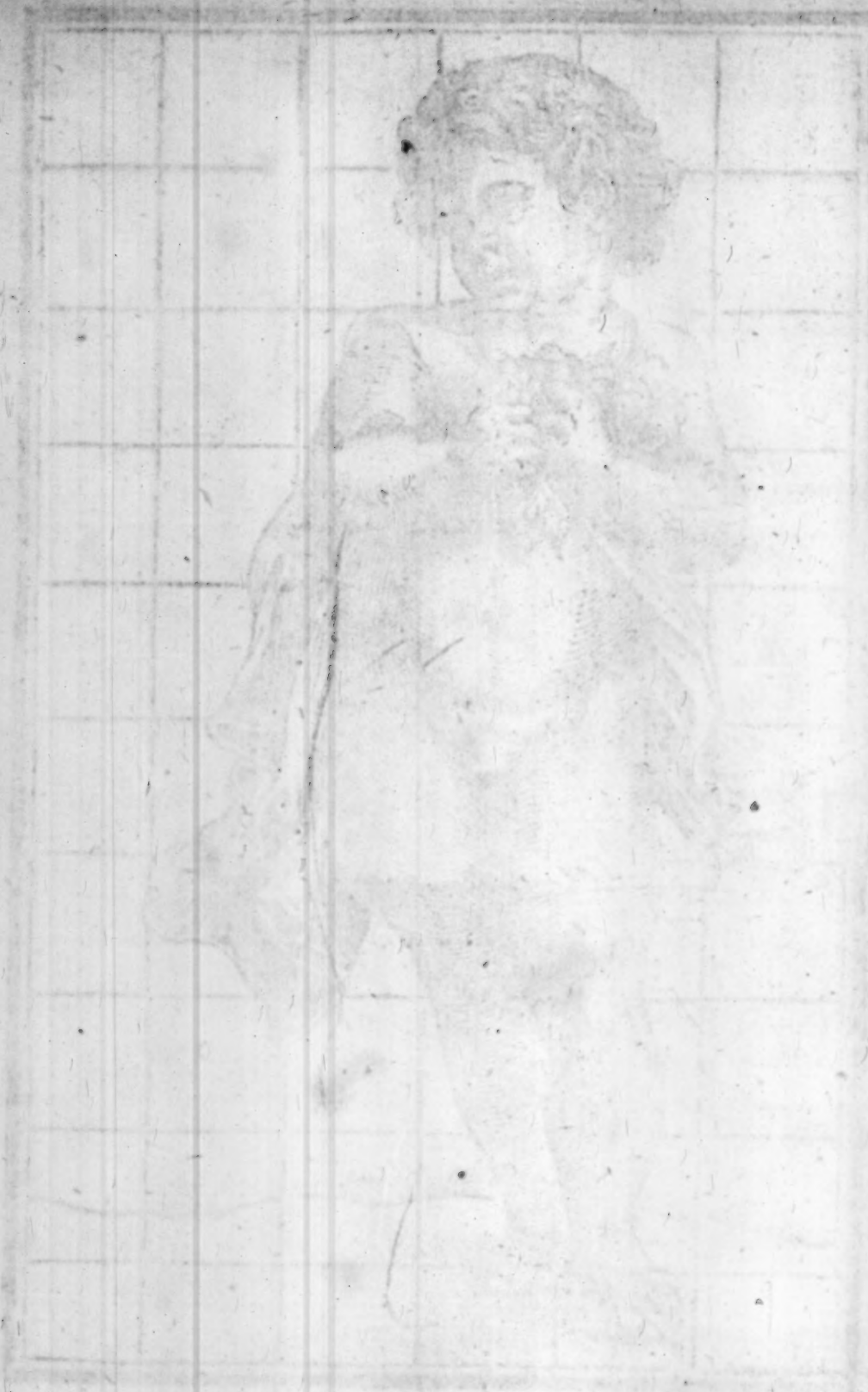
The manner of uſing this Desk is thus: If the picture that you intend to draw be a printed one, then firſt faſten it next unto the Desk with wax, paſte, or ſuch like: upon it faſten a ſheet of faire paper: If it be in the day-time, place the back of it towards the Sunne; if it be in the night that you worke, place a lampe behinde it, and ſo you ſhall ſee perfectly every (even the leaſt) ſtroake of the picture, which with your penne you may draw as acurately

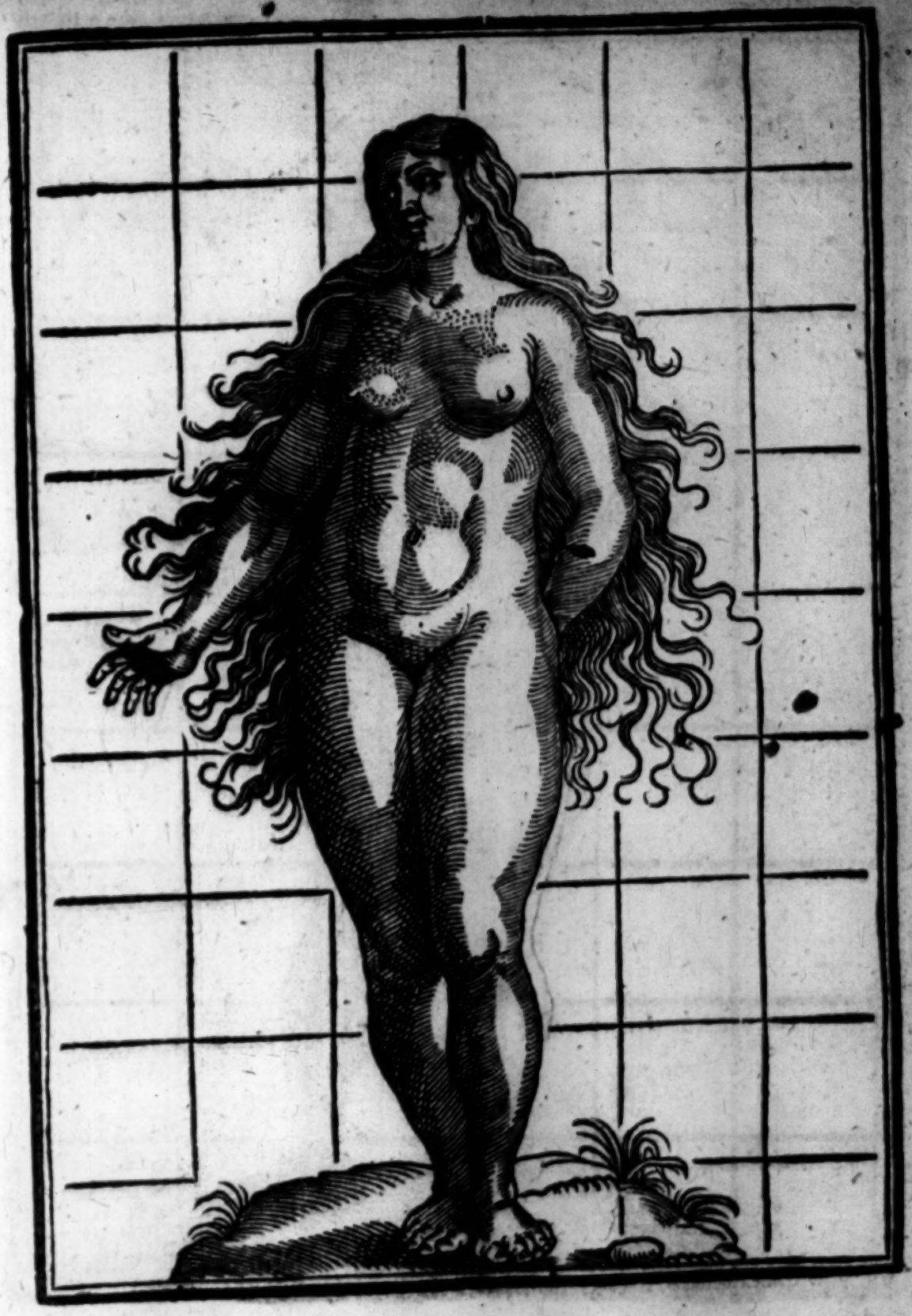
acurately as any Limmer whatſoever. If it bee a ſollid peece, then place it behinde the Desk, between the light and the Desk: then faſten a ſheet of cleane white paper upon the Desk; rayſe then the Desk higher, or lower, untill you ſee the perfect ſhadow of the image thorow your Desk, and paper, and then draw the poſture of the image, and ſhadow it afterwards (without the Desk) as light falleth upon it.

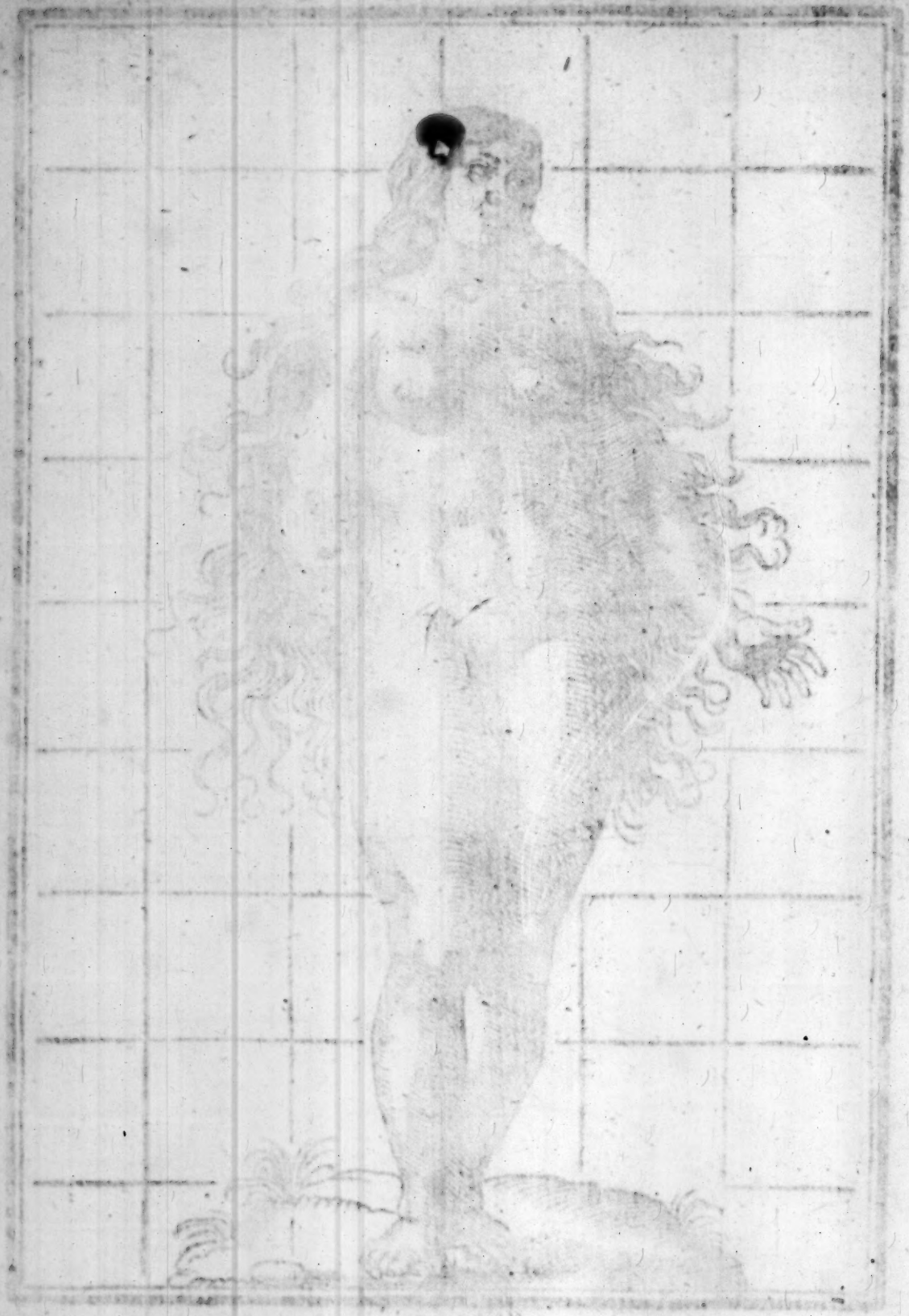
An eaſie way to take the naturall, and lively ſhape of the leafe of any herb or tree, which thing paſſeth the Art of man to imitate with Pen or Penſill.

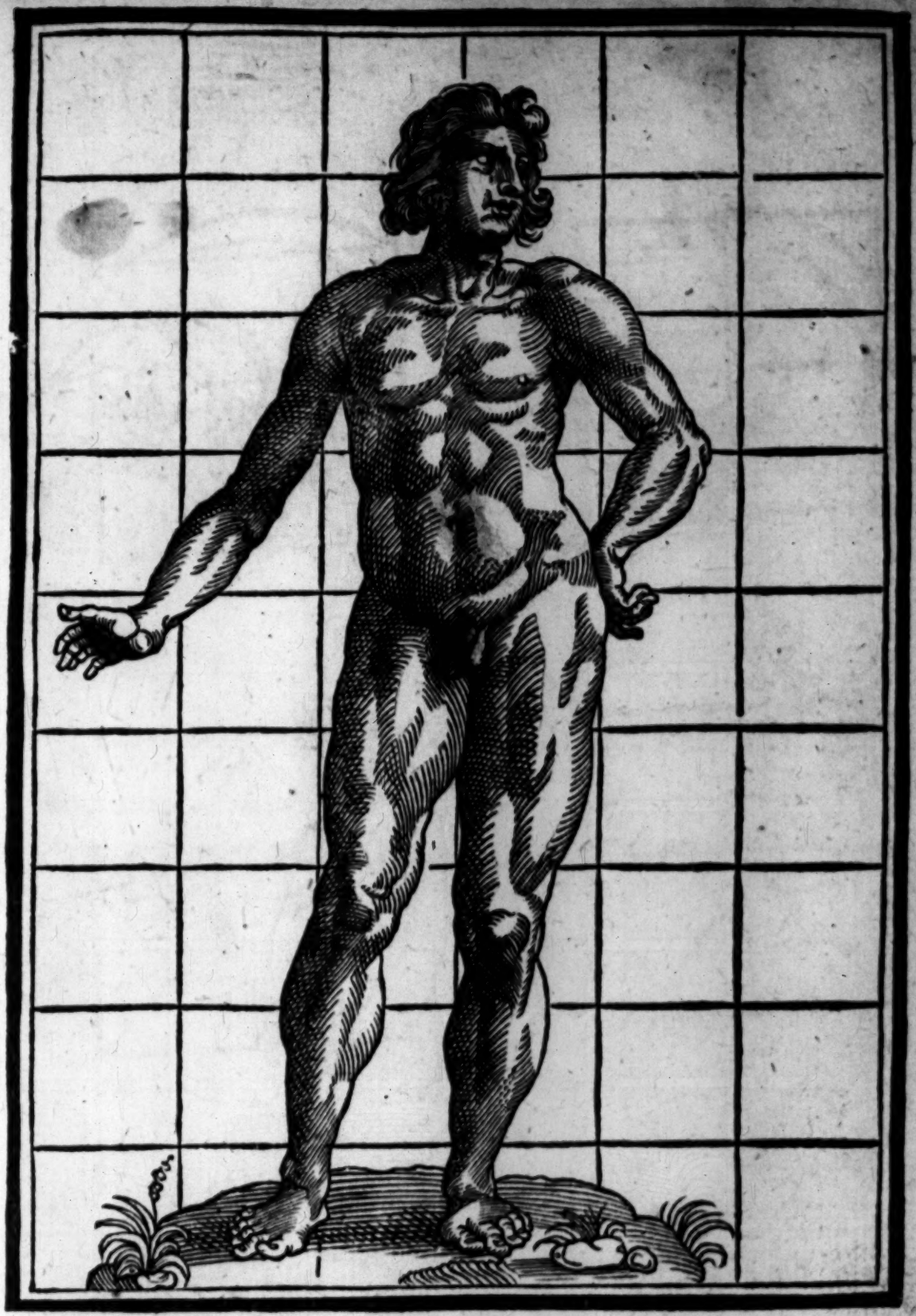
FIrſt take the leafe that you would have, and gently bruiſe the ribs and veines on the back ſide of it, afterwards wet that ſide with Linſeed oyle, and then preſſe it hard upon a peece of cleane white paper, and ſo you ſhall have the perfect figure of the ſaid leafe, with every veine thereof, ſo exactly expreſt, as being lively coloured, it would ſeem to be truly naturall, by this we learn, that Nature being but a little adjuvated or ſeconded with Art, can work wonders.

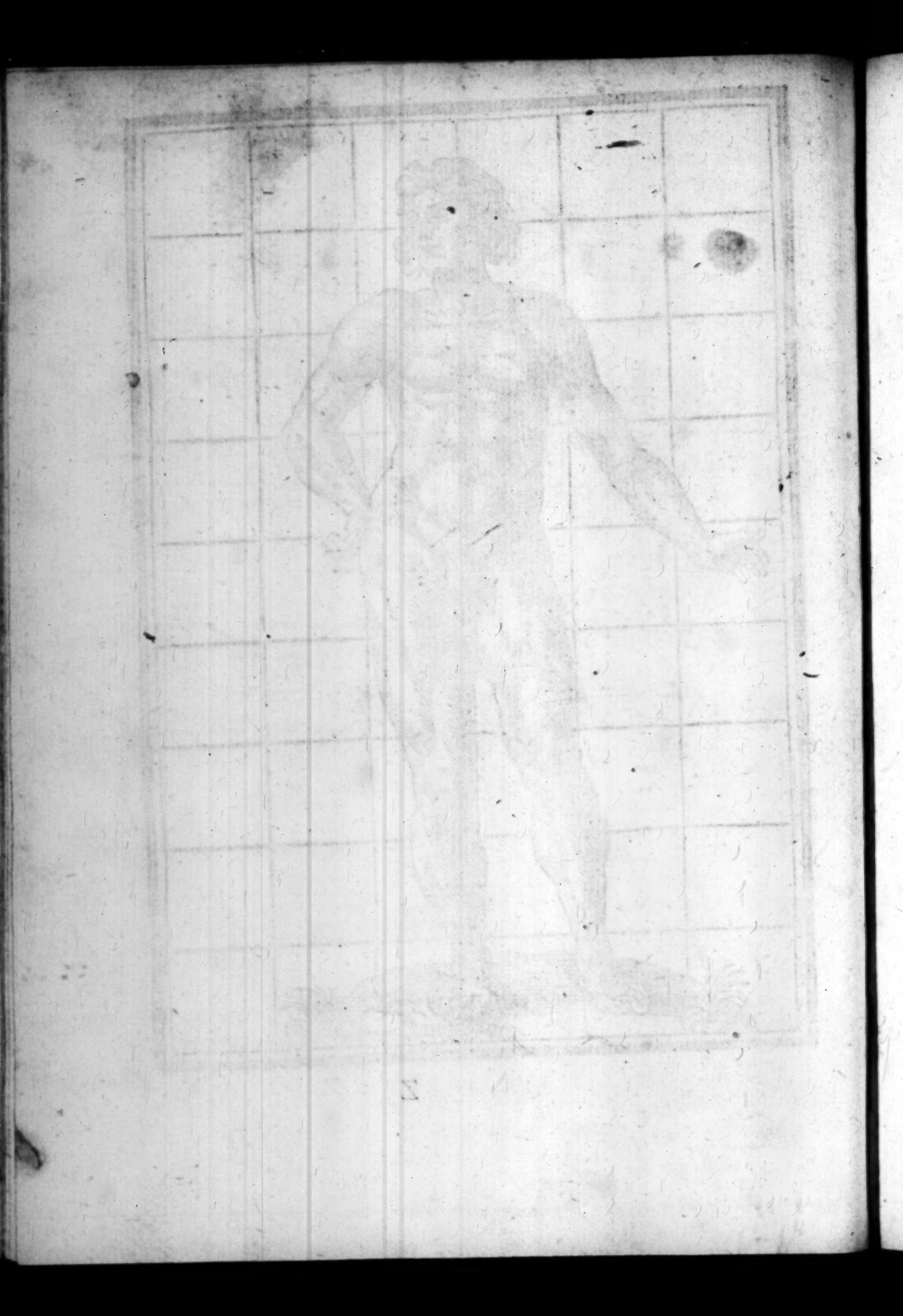
Now for the further information of ſuch as are deſirous of exemplary inſtruction, I have ſet down in order following the delineation of the proportion of ſuch things as in my judgement ſeemed moſt neceſſary for young beginners, and thoſe in ſuch eaſie demonſtrations as for the moſt part they conſiſt of equall ſquares, and require no more for their right underſtanding, then diligent obſervation: I might have filled a whole Booke of ſuch like, but having conſidered that what I had done, was a ſufficient ground for a further proceſſion, I thought fitting to leave each perſon to the exerciſe and practiſe of his beſt Invention.

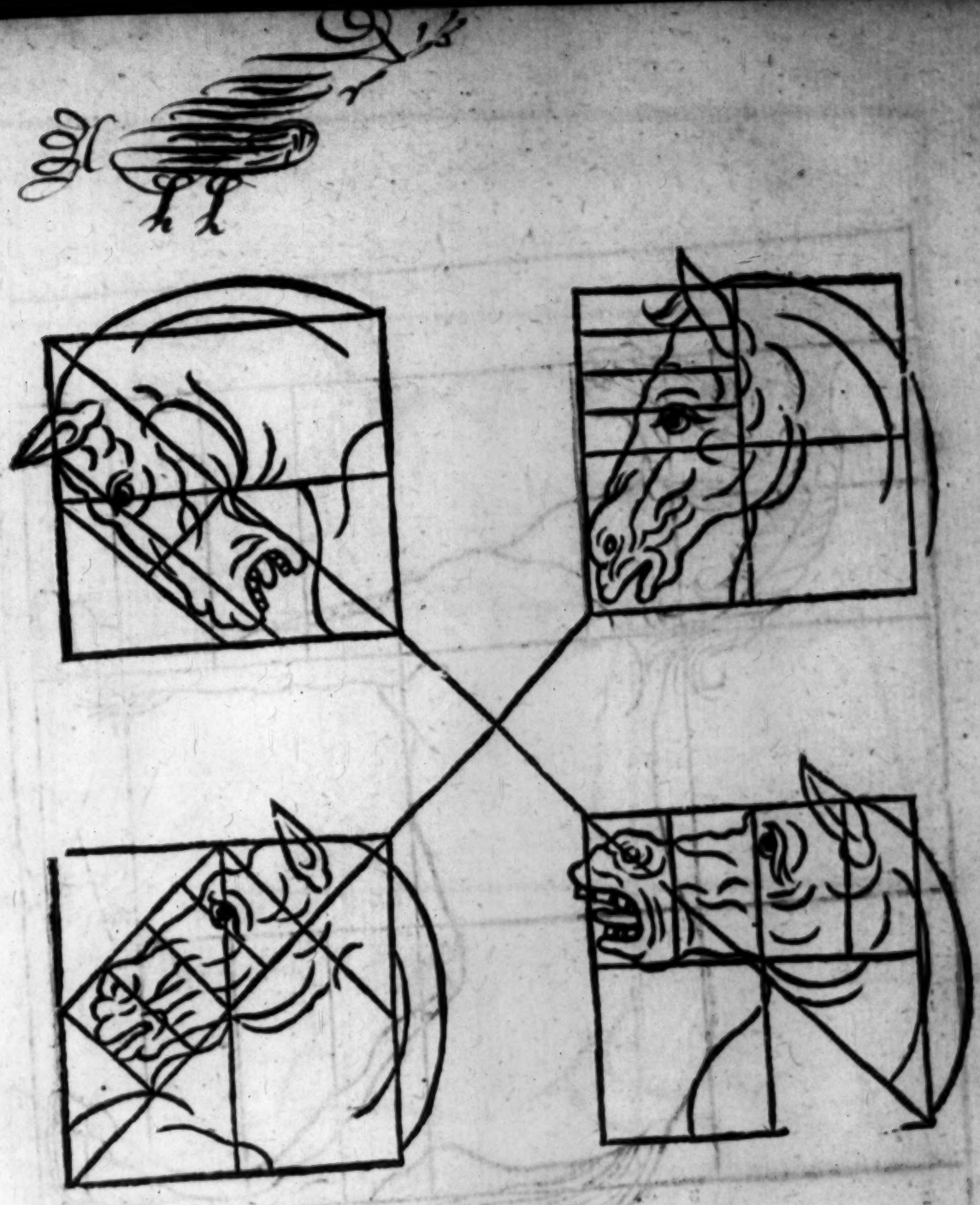


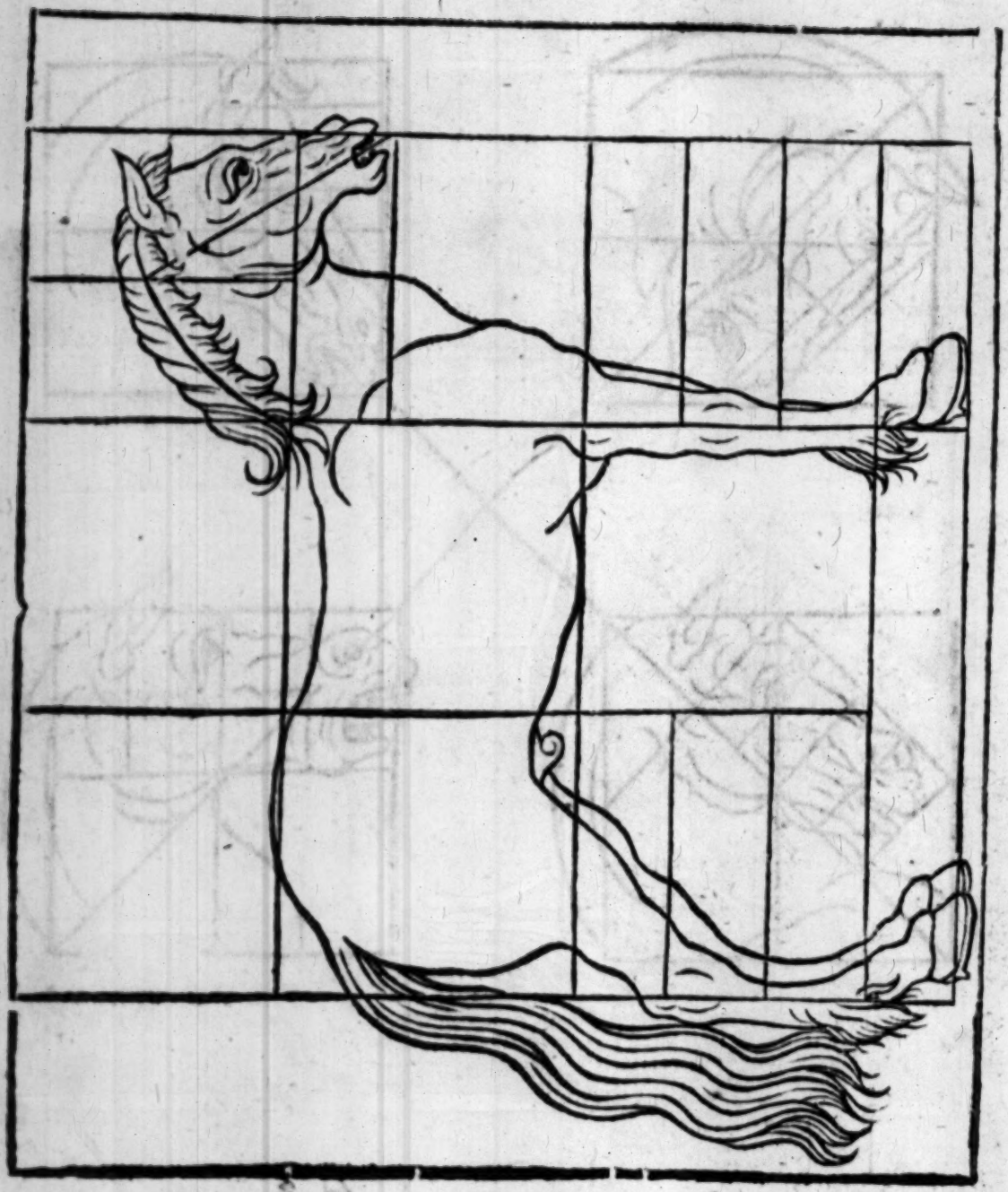


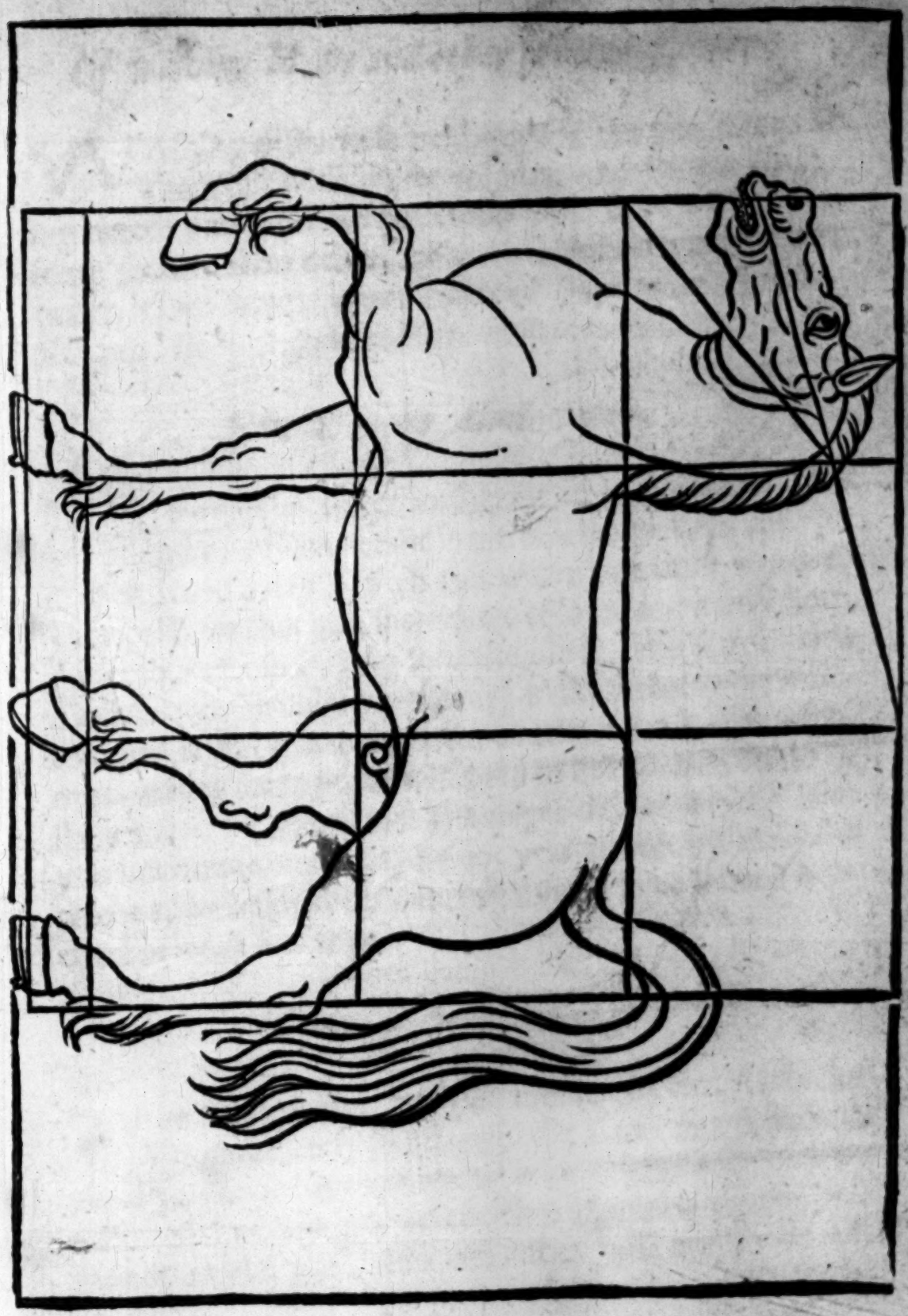


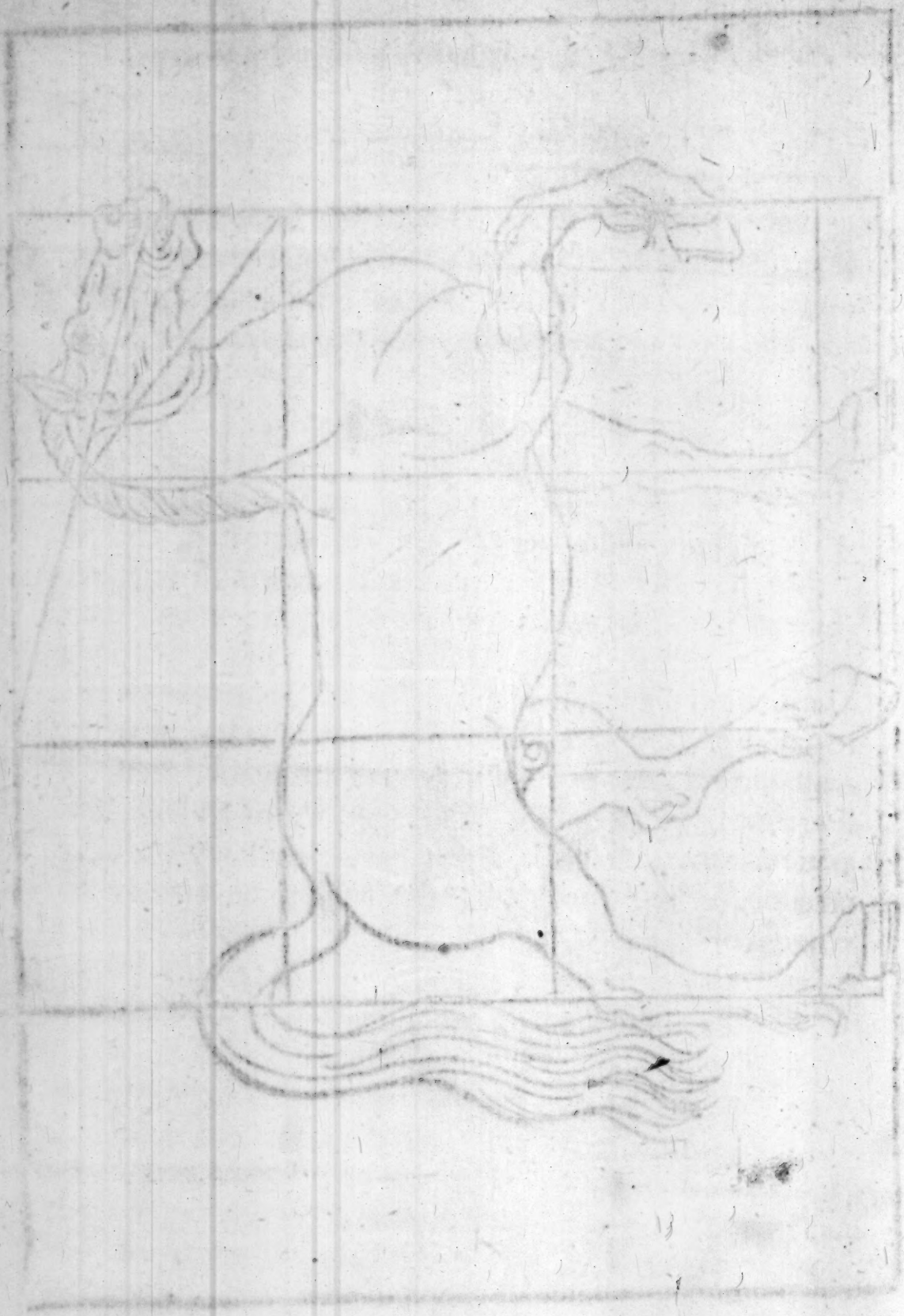












Of washing Maps and other printed pictures.

VVAshing pictures is nothing else but the setting of them out with water colours, and for the effecting hereof you must be provided with store of Pencils, some smaller than other, also with Allum water, Lime water, Gum water, water made of Sope ashes, size vernish, and store of good colours well prepared.

How to make Allum water.

TAke a quart of water and boile in it a quarter of a pound of Allum, seethe it untill it be molten, and let it then stand a day; with this water you must wet over your pictures that you intend to colour, for it will keep the colours from sinking into the paper, also it will adde a lustre unto the colours, that is, make them to shew fairer, and it will also make them continue the longer without fading; some paper will need to bee wetted foure or five times. You must let the paper dry of it selfe after you have once wetted it, before you either lay on your colours, or before you wet it againe, if so be it need a second or more wettings.

How to make Gum water.

TAke cleane water, and put into it of Gum Arabick a little, and let it stand untill the Gum bee dissolved. Now you must have a care that it be neither too thick by reason of the Gum, nor yet too thin; for with the one you cannot worke well, and the other will not binde fast enough;

enough ; with this water you muſt temper your colours before you lay them on your picture.

How to make Lime water.

TAke unſlackt Lime and cover it with water, an inch thick, let it ſtand ſo one night, in the morning poure off the cleere water, and reſeve it in a cleane thing for your uſe ; with this water you muſt temper your ſap green when you would have a blew colour of it.

How to make water of Sope aſhes.

STeep Sope aſhes a night in raine water, in the morning poure off the cleereſt: this water is to temper your Braſill with.

How to make Size.

TAke a quantity of Glew, and let it ſteep a night in water to make it the readier to melt in the morning: then ſet it on a coale of fire to melt, which done, (to try whether it be neither too ſtiffe, nor too weak, for the meaneſt is beſt) take a ſpoonfull thereof, and ſet it in the ayre to coole, or fill a muſcle ſhell with it, and let it ſwim in cold water to coole the ſooner. If it bee too ſtiffe when it is cold, put more water unto it, if too weak, then put more Glew unto it, and when you will occupy it, make it lukewarm, and ſo uſe it: this is to wet your clothes in if you intend to paſte your Maps or pictures upon cloth.

Of the manner of paſting Maps upon cloth.

FIrſt your clothes muſt bee cleane waſhed, and dryed, then wet them in your ſize, and wring it then hard out,

out, ſo nayle them ſtiffe upon a board or wall, then take your Map and wet the printed ſide with your Allum water and a bruſh, then turn the other ſide while it is wet, and paſte it all over with a bruſh, and ſo ſpread it upon your cloth being wet, then let it dry throughly, and laſtly lay on your colours. Note, that if you intend to verniſh your picture after it is coloured, then you muſt wet it at the firſt with thin white ſtarch warmed, inſtead of Allum water, but ſize is better, or elſe the verniſh will ſoak quite thorow it.

Note alſo, that unto every halfe pound of verniſh you muſt put two ounces of oyle of Turpentine, or elſe you cannot work it, it will be ſo thick.

How to prepare your colours.

SVch colours as have need of grinding, you muſt firſt grinde them with fayre water, and then put them upon a ſmooth chalk ſtone, and let them dry; then grinde them againe with Gum water, and reſerve them in muſcle ſhels for your uſe.

Chuſe to lay on the thinneſt and moſt tranſparant colours, eſpecially if it be good work that you are to colour, ſo the one will ſet out the other; but if the work be none of the beſt, then endeavour to hide the imperfections thereof by laying your colours the thicker on it.

A Sea colour.

TAke Privet berries when the Sunne entreth into *Libra*, about the thirteenth of September, dry them in the Sunne; then bruiſe them, and ſteep them in Allum

water, and ſtraine them into an earthen poringer that is glazed: or you may uſe them before you dry them, for the drying of them is to make them keep long.

Another.

Take blew Inde and ſteep it in water, and put to it a little verditer.

A yellow colour.

Take yellow berries and bruiſe them a little, and ſteep them a quarter of an houre in Allum water, then ſtraine them, if you will, or let them ſtand in the liquor, and work therewith.

A Ruſſet colour.

Take the fatteſt Sut you can get, and put it into a pot of cleere water, ſo that it be covered two or three fingers, and let it ſeethe well, which done, ſtraine it thorow a cloth, and ſet it on the fire againe to thicken, (but take heed that you ſet it not on too hot a fire, for feare of burning it) ſo let it boyle gently untill it be as thick as you would have it.

Colour for faces.

Firſt lay upon the cheeks little ſpots of lake or red lead, then come all over it with white, and a little lake; ſhadow it with lam black or umber, and white lead.

Hayre colour.

Take umber or Spaniſh brown, grinde it and temper it with Gum water.

Colours for naked pictures.

Take white lead and a little vermilion, temper them and lay them on, ſhadow it with bolearmenick in the middle, and adde a little Sut to the utmoſt or double hatches.

A colour for dead corps.

Change white lead with a little of the water of yellow berries, and waſh the picture all over, then change it with blew Inde, and ſhadow it in the ſingle hatches and leaneſt places; then take Sut, yellow berries, and white lead, and with that ſhadow the darkeſt places.

A blood red colour.

Sinaper, lake, and vermilion make a good blood red; ſome have commended mutton blood very highly, but I never tried it.

How to make mutton blood red.

Take ſome of the cleereſt blood of a ſheep, and put it into a bladder, and with a needle prick holes in the bottom of it, then hang it up to dry in the Sunne; this ſayth a Painter (that told it me for an eſpeciall experiment)

will make tranſparant and excellent blood red colour, which you may diſſolve in your Allum water, according as you have need thereof.

Colours for garments.

A purple colour.

Take Logwood and ſeethe it in vineger and ſmall beere in an earthen pot, and put a little allum therein, untill you taſte it to be ſtrong on the tongue.

A red colour.

Boyle Braſill as you did the Logwood, and it will make a red colour: if you would have it a ſad red, mingle it with pot aſh water, if you would have it of a light red, temper it with white lead.

A crimſon.

Cynaper tops: Cynaper lake: or vermilion.

A green colour.

Take Privet berry water, and change it with yellow berry water, and it giveth a perfect green for the ground, and it is much uſed.

Another green.

Take Spaniſh green cleane pickt and ſteeped in Rheniſh wine, ſtraine it, and put unto it a little hony or white ſugarcandy,

ſugarcandy, and it will make an excellent green.

For a light green.

Temper verdigreaſe and white lead, 2. verdigreaſe as much yellow berries, and a little white.

Yellow colours.

Orpiment and Saffron, Maſticol, Gambougium; either of theſe give a very good yellow.

Blew colours.

Verditer, Azure or Bice, blew Inde.

Colours for building.

Lay black and white lead for the wals of Churches, Conduits, and greater buildings; Bolus for the pillers, and leſſer houſes; red lead for tyles, for the Leads blew and white; for cottages Sut alone.

Colours for Landskip.

Lay verditer, blew, white, and green; or firſt go all over it with ſaffron, and white; then put a little Sut to them, and go over it againe.

Or firſt take green and white lead, and go over it, ſhadow it with a little more green, then with white, and laſt of all with green, a little white and yellow berries.

Sky colours.

Braſill and white lead is the lighteſt, then light purple and white, then Inde blew and white, the darkeſt of all is Inde blew.

Cloud colours.

The lighteſt of all is white lead and Inde blew, a like quantity of each : the next, a great deale of Inde and a little white ; then purple and white with a little Braſill ; then white lead and yellow berries.

Colours for the Sunne beames.

Lay yellow berries with a little white, ſhadow it with ſaffron and red lead.

A motley green.

This colour is compounded of red and green.

A Lincoln green.

This colour is compounded of a good green and ſaffron

A popiniay green.

This colour is compounded of azure and maſticot, or blew and yellow.

An excellent green.

Take copper plates, put them into a pot, and put ſome diſtilled vineger unto them, ſet them in a warme place untill the vineger become blew, then poure that liquor or coloured vineger into another pot well leaded, and poure more vineger upon the copper plates againe, letting that alſo ſtand untill it be of a blew colour, then poure it unto the former liquor, this you may do ſo often untill you have liquor enough, then let that liquor ſtand in the Sun untill it be thick enough.

A Lion tauney.

This colour is made of red lead and maſticot.

A peach colour.

This colour is compounded of ceruſe and vermilion.

A braſſe colour.

This is made of maſticot and umber.

A marble or aſh colour.

This colour is made with black and white.

A ruſſet colour.

This colour is made with a little white and a good quantity of red.

A

A brown blew.

It is made of two parts Inde baudias, & a third of ceruſe

A Crane colour.

It is made only of black lead ground with gum water.

To write gold with the Pen or Pencill.

Take a ſhell of gold, and put a little gum water into it, and ſtir it about, and then you may work with it as with colours.

Thus by a little practiſing and tempering your colours one with another, you may with the ſame colours compound divers others that I have not mentioned, nay almoſt what you liſt.

Of Limming.

Limming consisteth not only in the true proportioning of a picture, but also in a neat and lively colouring of the same, whereby the work is so graced oftentimes, that smaller faults are seldome perceived, except it be by those that have very good judgement: and herein I will speak first of the names of all the colours pertaining thereunto; also of the names of your gummes and golds; then how you shall dissolve your gummes; then of grinding your colours, and making them operative; of all your waters to diaper, damask, and set out your colours: lastly, of making your gold sizes both for burnished and set gold, and to make your gold small to armoniack with a Pencill, for writing, stock painting and other work.

The names of all the colours pertayning unto Limming.

Blewes.

1 Blew Bice.
2 Inde baudias.
3 English Inde.
4 Litmose blew.
5 Flory blew.
6 Cork or Orchall.

Greenes.

1 Green Bice.
2 Verdigreaſe green.
3 Verditer green.
4 Sap green or Pancy green.

Reds.

1 Vermilion red.
2 Red lead.

Yellowes.

1 Orpiment yellow.
2 Pinck yellow.
3 Oker de Luce.
4 Maſticot or generall.

Crimſons.

1 Fine Roſſet.
2 Sinaper lake.
3 Sinaper tops.

Sanguins.

1 Sanguis Draconis.
2 Turnſole.

Brownes.

1 Spaniſh brown.
2 Bole armenick.
3 Vmber.

Whites.

1 White ceruſe.
2 White lead.
3 Spaniſh white.

Blacks.

1 Black chalk.
2 Coppres black.
3 Sable black.
4 Baſe black.
5 Lamp black.

The names of the Gums.

1 Gum Armoniack.
2 Gum Lack.
3 Gum Hedere.
4 Gum Arabick.

The

The names of your golds.

1 Liquid gold.
2 Gold armoniack.
3 Gold burniſhed.
4 Set gold.

How to diſſolve your Gums.

The manner of diſſolving Gum armoniack, and for what uſe it ſerveth.

TAke Gum armoniack and grinde it with the juce of Garlick as fine as poſſible may be, then put thereto two or three drops of weak gum water of Arabick, and temper it ſo that it be not too thick, but that it may bee convaid out of your pen; then write therewith what you will, and let it dry; when you would gild it, cut your leafe gold or ſilver in ſmall peeces according to the writing you are to lay it on: firſt then breathe upon your writing or drawing, and incontinently ſet your gold or ſilver hard on with a peece of wooll, then let it dry throughly, afterwards with a fine linnen cloth ſtrike away the looſe gold or ſilver, and you ſhall finde the ſithe that you formerly drew to, though it bee as ſmall as the hayre of your head, to be cleane gold or ſilver, and this is called gold armoniack, and it may ſerve alſo to temper liquid gold with.

Gum Hedere, how to make it, and to what uſe it ſerveth.

SEek a tree that hath a great branch or arme of Ivie, then hew the Ivie aſunder in the midſt, and bruiſe both

the ends of it with the head of your Ax, ſo let it remaine three or foure weeks, and then you ſhall finde a pure gum much like an oyle to iſſue forth of the ends thereof, which gather up, for it is good to put into your gold ſize, and alſo into your other colours, and that for three cauſes: firſt, it will ſtay the taſte and odour of your ſize; ſecondly, it will prevent the bubbles that would ariſe upon your gold ſizes and other colours; thirdly, it will make that the colours ſhall not be fat and clammy.

How to make Gumlack, and the uſe thereof.

TAke the glayr of egs, and ſtraine them as ſhort as you can, in the month of March; to a pint of this put a ſpoonfull of the fineſt wort that you can get, alſo take hony and gum hedere, of each as much as a hazle nut, and put to them foure ſpoonfuls of the fineſt wort, ſtraine them with a peece of ſpunge ſo long that you ſee them a cleere oyle; put both theſe together into a glaſſe, and let it dry, and it will be hard like amber, which you may diſſolve in cleane water, as you do gum arabick. This is the beſt verniſh that is, and it is good to lay many colours with, as you ſhall finde in the temperature of them.

How to make glayr.

TAke the whites of egs, and beat them with a ſpoone (or whisk, which is better) till it riſe all in a foame, then let them ſtand all night, and by the morning they will bee turned into cleere water, which ſhall bee good glayr wherewith you ſhall temper your colours.

How

How to make gum water for the ſame uſe.

TAke gum arabick that is white and cleere, knit it up in a clout, and lay it in cleane water untill it bee diſſolved and make the water clammy: if you put too much water and too little gum, you ſhall have a weak gum water, and ſo of all other gums. Let it not be ſo ſtiffe that your fingers ſtick together being wet therewith, but of a reaſonable ſtiffneſſe.

Of the tempering and making Colours.

SOme Painters uſe firſt to grinde all their colours except white, with the gall of a Neat, and then let them dry, and afterwards they grinde them againe with gum water, and ſo uſe them; water, they ſay, killeth the brightneſſe, and the gall maketh the colour more lively.

Obſervations.

THe practices of a Limmer muſt be neat and cleanly in all the operations, in grinding colours where there is neither ſmoak nor duſt; the water of ſome cleere ſpring, the gum of the whiteſt and cleereſt Arabick, broken into powder: he muſt have alſo white ſugar candy in powder, and theſe muſt be kept cloſe in gally pots, or jar glaſſes: his grinding ſtone muſt be of chryſtall, porphyr, or green marble; his apparrell ſuch as ſheddeth leaſt duſt.

Of blew Byce, how to grinde and temper it.

TAke fine byce and grinde it upon a cleane ſtone with faire water, as ſmall as you can grinde it, then put it into a horn or horſe muſcle ſhell, and waſh it in this manner following: Firſt put thereto your horn full of cleane water or vineger, and ſtir it well, then let it ſtand the ſpace of an houre, and all the byce will fall to the bottom, and the corruption ſhall fleet upon the water, then poure away that water, and then put to it ſomewhat a weak gum water, that the colour may fall to the bottom; let it then ſtand untill the byce be all ſetled to the bottom, then poure away that gum water cleane from the byce, and put thereto other cleane water, and ſo waſh it up, and if you will have it riſe to the ſame colour it is of when it is dry, then temper it with a weak gum water, if otherwiſe, then temper it with a ſtiffe gum water of lack.

If you will have it light, grinde it with a little ceruſe.

If you will have it deep, put to it the water of Litmoſe.

If you will make a falſe colour hereof, put to it twice ſo much ceruſe, and deep it with deep azure, but after that diaper or trace with ceruſe or white lead.

Byce, cinaper, lake, and a little roſſet make a faire violet colour.

Vltermerine of *Venice* is the higheſt blew, inſtead whereof you may uſe ſmalt of the beſt blew byce.

Litmoſe blew.

TAke fine Litmoſe and grinde it with ceruſe: and if you take Litmoſe and a little ceruſe, it maketh a deep blew.

If

If you put much ceruſe and a little litmoſe, it maketh a light blew, you muſt grinde it with weak water of gum Arabick.

How to make blew water to diaper and deepen upon all other colours.

Take fine litmoſe cut into peeces, and lay it in a weak water of gum lack, and let it lie twenty foure houres therein, and you ſhall have a pure blew water, as blew as azure: with this water you may diaper, damask, and ſet out all other blewes.

Or take a little quantity of unſlakt lime, and a good quantity of litmoſe, and grinde it with a ſtrong lime lie, then put it into a horn, and let it rot in horſedung, the longer the better.

Inde baudias and Engliſh Inde.

Take Inde baudias and grinde it with the water of litmoſe, if you wil have it deep; if you wil have it light, grinde it with fine ceruſe, and weak water of gum Arabick. In the ſame manner muſt you grinde your Engliſh Inde, but it maketh not ſo good a colour as your Inde baudias, you muſt diaper upon it with litmoſe water.

Some inſtead of this colour uſe flory with a little Inde roſſet, and ceruſe twice as much, and it maketh a light violet:

With one part of Inde, and two parts of roſſet is made a deep violet.

Inſtead of Inde one may have a little flory, and for a violet colour it is better than Inde.

Flory

Flory must be tempered as is Inde.

Inde is a colour between blew and black, and must be well ground with gum water, and tempered as rosset is.

Flory blew.

Take fine flory blew, and grinde it with a little rosset, and it maketh a ligh violet. Put much ceruse and a little red lead, and it maketh a crane feather colour. Grinde this with any yellow, generall excepted, and also saffron, and it maketh a faire green.

This colour ground with a little blew byce, and a little quantity of chalk, maketh a light colour.

This colour must be ground with glayr, and tempered with some Spanish white, else it will be little better then chalk.

Kork or Orchall.

Take fine orchall and grinde it with unslaked lime, and with a quantity of urin, and it maketh a pure violet. If you put much lime, it maketh a light violet. If you put too much kork or orchall, it maketh a deep violet; but orchall is the better colour.

Green colours,

The best green for Limming is Cedar green, instead whereof you may use verditer green.

How to grinde and temper green byce.

You must grinde your green byce on the same manner you

you did your blew byce, alſo temper and maſh it after the ſame manner; and you muſt diaper upon it with the water of deep green, as you ſhall finde hereafter. The longer it is ground, the finer it will be, but the more waſte. The refuſe of this byce may ſerve to make hils and ſtalks of flowers. Moreover, this colour being a falſe colour, muſt be deepened with ſap green, and diapered with gals.

Verditer green.

Take your verditer, and grinde it with a weake water of gum Arabick. This is the fainteſt green that is, but it is good to velvet upon black, to make the ſleeve of an Image, or to velvet a quiſhion.

Verdigreaſe green.

Take ſome verdigreaſe, and grinde it with the juce of Rue, and with a little weak gum water, and you ſhall have the pureſt green that is: and if will have it to diaper upon, then you muſt grinde it only with the juce of Rue, and that will make it a worſe green, and then your damask or diapering ſhall be perceived.

You muſt diaper upon it with the water of ſap green.

Sap green.

Take ſap green and lay it all night in tart vineger, or cleane water not gummed, and put a little allum thereto to raiſe your colour, and you ſhall have a good green to diaper and deepen upon all other greens.

How to make ſap green.

Take the berries of wine thorn, which is much like unto a ſlo tree, the berries thereof are black, and grow in cluſters like the berries of ſartridge, whereof Butchers make their pricks; but theſe berries differ in this from the berries of the ſartridge; theſe are full of juce, and thoſe are dry, and have a hard kernell within them. Take, I ſay, the berries of wine thorn, and wring the juce from them therow a courſe cloth, and put thereto the powder of allum, to preſerve the colour of the juce, then ſeethe them together untill it be almoſt waſted away; when it is ſomewhat ſtiffe, take it out of the veſſell wherein it was boiled, and make of it a ball; when you will uſe it, take thereof a little, and put it into a ſhell of faire water, for it is ſtrong enough of it ſelfe.

Of vermilion red.

Vermilion is a principall and excellent red colour; in the grinding of it adde a little hony to make his colour bright and perfect. There are two ſorts of this vermilion, the one is naturall, and the other artificiall; the naturall is very hardly to bee got, and it is a farre more excellent colour than the artificiall. It is found in ſmall quantities amongſt your red orpiment, and you may eaſily know it, for it doth much reſemble the artificiall. The artificiall vermilion is made of quickſilver, and citrin, ſulphur or brimſtone burned together.

Of red lead.

Red lead is made of ceruſe burnt, and unto it you muſt adde

adde a little ſaffron in the grinding, for that will make it of an orient and marigold colour; you muſt waſh it, and take the fineſt for Limming.

Of orpiment.

Orpiment is a minerall, and reſembleth gold when it is broken, it muſt be firſt ground with a ſtiffe water of gum lake; it giveth the beſt colour of it ſelfe without any mixture: if you lay it upon green, white lead, red lead, or ceruſe, they will ſtaine it. There are two ſorts of yellow orpiment; the one, which when it is broken, looketh, as I ſayd, like unto gold; the other is more brittle, and it is of a deep marigold colour, but being ground, it maketh of it ſelfe a moſt excellent yellow, which I have often uſed.

Of pinck yellow.

You muſt grinde this colour with ſaffron if you will have it ſad, if light, with ceruſe.

Of Oker de luce.

Oker de luce is a good hayre colour, and a naturall ſhadow for gold.

Of maſticot or generall, or generall yellow.

Grinde the maſticot with a ſmall quantity of ſaffron in gum water, and never make it lighter than it is. It will endure and lie upon all colours and metals.

Of roſſet, cinaper lake, and cinaper tops.

Theſe colours you muſt grinde each by themſelves, with gum water. Lake of India is of a crimſon colour, other lakes there are that are blacker, and they muſt bee ground with ſugarcandy or ſugar.

Of Sanguis Draconis.

Sanguis Draconis muſt firſt be purified from his droſſe, and then ground with gum water.

Of Turnſoil.

Turnſoil is made of old linnen rags died; you ſhall uſe it after this manner; lay it in a ſaucer of vineger, and ſet it in a chafingdiſh of coles, and let it boile a little, then take it off, and wring it into a ſhell, and adde thereto a little gum Arabick, and let it ſtand untill the gum be diſſolved; it is good to ſhadow all carnations and yellowes.

Of brown of Spaine, and umber.

Grinde your Spaniſh brown with braſill water: in like manner grinde your umber.

Of bolearmoniack.

Grinde bole armoniack with gum water:

Of ceruſe.

Ceruſe muſt bee ground with glayr of egs that hath lien

lien rotting a month or two under the ground, and it will make a moſt perfect white; this colour being ground and waſhed, will yeeld three ſorts of whites; the firſt whereof is the fineſt, and it will gliſſen, this I call ſattin white: the ſecond is good for Limming; and the courſeſt of all being once ground againe, is beſt to be uſed for the fleſhy colour, properly called carnation, which in no ſort ought to have any gliſſening in it. This colour with a little red lead maketh the faireſt carnation. If the party bee pale, leſſe red lead and a little maſticot among it; if brown, more of each, and a little oker de rous withall.

Of white lead.

This is the ſame with ceruſe, but it is not refined as that is; grinde it with a weak water of gum lake, and let it ſtand three or foure dayes; roſſet and vermilion make it a faire carnation.

Of Spaniſh white.

You muſt grinde your Spaniſh white with a weak gum water. It is the beſt white to lace or garniſh withall, and it is thus made; take fine chalk and grinde it with the third part of allum, in faire water, untill it bee thick like pap, then make it up into bals, and let them lie by untill they are dry; when they are dry, put them into the fire, and let them remaine untill they be red hot, like burning coales, then take them out, and let them coole.

To make liquid gold or ſilver.

Take five or ſix leaves of gold or ſilver, and lay them

upon your grinding ſtone, and grinde them with a ſtiffe gum water, and a pretty quantity of ſalt, as fine as poſſibly you can, then put them into a iar glaſſe, and fill the glaſſe almoſt full of faire water, to the end the ſtiffe water may diſſolve, and ſo the gold may fall unto the bottom of the glaſſe: let it ſtand three or foure houres, then poure away the liquor from the gold, and put more cleane water, and ſtir it about, and let it ſettle againe, and then poure off the ſame water; do this ſo often untill you ſee your gold or ſilver cl ane waſhed; then take clean water, and put thereto a little peece of ſal armoniack, and great ſalt, and let it ſtand the ſpace of three dayes in a box made of wax, then take a peece of Glovers leather, and pick away the skin ſide, and put the gold and the water therein: tie it up then, and hang it on a pin, and the ſalt will fret thorow, and the gold will remaine, which you ſhall temper with the glayr of egs, and ſo uſe it with your pen or pencill.

Of gold armoniack.

The making of gold armoniack you are taught before in the diſſolving of the gummes.

To make ſize for burniſhed gold.

Take three parts of bole armoniack, and the fourth part of fine chalk, grinde them together as ſmall as you can with cleere water, three or foure times, and after every time let it dry, and then take your glayr of egs, and ſtraine them as ſhort as water, and then grinde your bole and chalk therewith, and in the grinding put a little quantity of gum hedere to the quantity of a fitch, and foure

or

or five blades of saffron, grinde them all as small as possibly you can, and put them into an Ox horn, and let it rot in horsedung the space of five or six weeks, and then take it up, and let it have the ayre, for it will have an ill savour, then occupy it when you will, after this manner; lay this size first upon your parchment, and with a feather lay your gold or silver upon it, and when it is dry, burnish it.

How to make another double size to lay gold or silver upon an embossed ground.

Take *Venice* ceruse, white lead, plaster of an old image, or chalk; any of these made into fine powder, and ground with the white of an eg, and a little water; this will make a good bottom to lay silver on. But when you use any of these to lay under gold, put to it a little saffron, put not too much water, mingle it after discretion, and look the size be thick standing; put the size thus tempered, in a horn or shell, in some celler or shadowed place, where it may stand moyst seven dayes, till it be perfect clammy and rotten, and once a day stir it; the older the size is, the better it is. If there stand any bubbles upon the size, put in a little eare wax, for that is a remedy against it, and before you lay it on your work, lay the size upon a horn, & dry it, and when it is dry, bend it, and if it bend and break not, then is it perfect; if it break, put a little water to it, to make it weaker, and prove it if it cleaveth fast unto the paper, if not, put glayr thereto, and it will make it more stedfast. The like size you may make of gipsum, bole armoniack, red or yellow oker, orpiment, or masticot, with brown of Spaine, or red lead, if every of them be ground, and tempered as the former.

How to ſet gold or ſilver.

Take a peece of gumlack, and diſſolve it to a ſtiffe water; then grinde a blade or two of ſaffron with it, and with your pen or pencill make what work you pleaſe, and cut your leafe gold or ſilver into peeces, according unto your drawings, and take them up with a feather, and lay them on your drawings, and preſſe them down with a peece of wooll; when it is through dry, ſtrike off the looſe gold or ſilver, and burniſh it with the tooth of a dog faſtned in the end of a ſtick.

Aurum muſicum.

Take one ounce of ſal armoniack, one ounce of quickſilver, of counterfoine one ounce, and of brimſton halfe an ounce, bruiſe the brimſton, and ſet it on the fire, but let it not be over hot, (leſt it burn) then put in the ſal armoniack being in powder, alſo the quickſilver, and counterfoine, being well mixed therewith, put them, I ſay, into the brimſton, and ſtir them very well, and quickly, with a ſtick, untill the brimſton become hard, then grinde it on a ſtone, and put it in a glaſſe well ſtopped with wax, and ſet it in a pan of aſhes, make a fire under it, and let it ſtand halfe a day in that manner, till a yellow ſmoak ariſeth on it, and when the yellow ſmoak is gone, it is prepared.

Argentum muſicum.

Take one ounce of tyn, melt it, and put thereto one ounce of tartar, and an ounce of quickſilver, ſtirre them wel

well together, untill they be cold, then beat it in a morter, and grinde it with a ſtone ; temper it with gum water, write therewith, and afterward poliſh it.

How to write a gold colour.

Take a new layd hens eg, make a hole at one end, and let the ſubſtance out, then take the yolk without the white, and foure times ſo much quickſilver in quantity, as of the former ; grinde them well together, and put them into the ſhell, ſtop the hole thereof with chalk and the white of an eg, then lay it under a hen that ſitteth, with ſix more, for the ſpace of three weekes, then break it up and write with it.

To diaper on ſilver or gold.

Diaper on gold with lake and yellow oker, but upon ſilver diaper with ceruſe.

Of the light and place moſt meet to be choſen, and of certain neceſſary obſervations.

Let the light whereby you work, be northward, ſomewhat towards the eaſt, which is commonly without Sunſhine ; let it be one only light, and that great and fayre, without reflections of wals or trees, a free sky light, the greater the window, the better, but no bay window ; in ſuch a place alſo where neither duſt, ſmoak, noyſe, nor ſtink may offend, for the colours themſelves may not endure ſome ayres, eſpecially the ſulphurous ayres of ſeacoale ; and in any wiſe avoid anger, and ſhut out buſybo-

dies, and ſuch as love to be fingering; and ſpeak not over your picture, for the leaſt ſpot of wet falling upon it, can never be amended.

In drawing after the life, change not your light, but end your work by the ſame light that you begin it in, if poſſibly you may.

Virgin parchment, that is, ſuch as is made of the skins of caſtlings or abortives, free from ſpots, and fine and ſmoothly dreſt, ſtrained and paſted with ſtarch upon ſmoothed paſtbord, is the beſt to lim upon.

When you begin your picture, lay firſt too faire a carnation, for in working you may make it as brown as you will, but being choſen too brown, you ſhall never work it faire enough; for limming is but the ſhadowing of the ſame colour that your ground is of. All ground colours in limming muſt bee layd ſomewhat flowing, that it dry not before your pencill, leſt your work ſhew rough and patched.

When you draw upon the ſame ground, be very adviſed what lines you draw, and draw them very lightly with ſome of the ſame carnation and a little lake thinly mixed, or with a little thin lake alone, with a very ſmall pencill, that it may ſcarce at the firſt be diſcerned, untill you be ſure that you are in the right way, for afterwards it is very hardly altered. In ſhadowing alſo uſe the ſame diſcretion, let it be performed by little and little, at the firſt too white, for the face at the firſt being made never ſo little too red, or too brown, can never bee amended; ſhadowing too much is never to be amended; alſo if the hayre be made too dark, or the forehead too low, they are very hardly or never to be amended; wherefore make the forehead too high at the firſt, and you may be ſure to

amend

amend it, bee not too hasty to lessen it, but proceed with judgement and consideration.

To draw the trace after the carnation is layd, and to give the red to the cheeks, take lake and vermilion, and for to give the light, take *Venice* ceruse only, for an old man adde a little oker unto it, for the shadowes take a little black and lake, but for a woman make it very white, for an old man take the other shadowes and a little soot, for the last shadow for the compassing of the face, take lake a little black, with some russet oker, and soot; as for the hayre, it must bee shadowed according unto the colour thereof.

Shadowing in limming must not bee driven with the flat of the pencill, as in oyle work; distemper or washing, but with the point of the pencill, with little touches, of colours, very thin and like hatches, though the shadows be never so great, yet must it be made after the same manner, with little touches, but trench not too long in one place, lest it glissen, but let it dry an houre or two, and then deepen it againe.

And to make one the more perfect in this work, it were good to practise to hatch some well graven small peeces of *Albertus Durer*, to the end you may handle the point of the pencill in like manner.

Keep your colours ready washed, dried, and ground, each in severall boxes, apart by themselves, and temper them by little and little, as you have occasion to use them; for a colour after it is once dried in the shell, never worketh so well afterwards: But if it happen that you have tempered too much of a colour, and that it bee dried in the shell, you must temper them with your finger very cleane, when you will use thereof, adde a little gum, if it

temper not well, but beware you put not too much gum in.

If any colour crack too much in the ſhell, temper therwith a little ſugarcandy, but not too much, leſt it make it ſhine.

If a colour will not take by reaſon of ſome ſweaty hand that hath touched your parchment, temper with your colour a little eare wax, to give it as it were a taſte. The ſame is good likewiſe if any colour peele off, to temper the colour that you mend it with, and it will never peele any more.

Want of gum is the cauſe that your colours temper like lome or clay, and will draw no line at all.

Of mixing and tempering colours.

White lead with yellow oker, maketh a ſtraw colour; with adding azure, it maketh a sky colour; and ſo likewiſe by adding ſmalt and verdigreaſe, or pinck it makes the colour of leaves, and herbs. White with the ruſt of iron maketh the agat colour. White with endego, makes a sky colour. White with vermilion, makes the colour of unripe ſtrawberries. White with carnation, makes the colour of damask roſes. White with umber and other ſhadowing earth, makes the colour of barks of trees, blocks, wood, and ſtones.

Yellow with vermilion, makes the colour of fire ſhining, alſo an orange tawny.

Lake and azure make a violet or columbine colour: vermilion and lake make the colour of ripe ſtrawberries, roſes, rubies, red lips, blood and ſcarlet.

Verdigreaſe with pinck, maketh a very freſh green. Azure,

zure, ſmalt, and pinck make a dark green.

Azure with turnſole makes a purple or violet colour, and ſo with roſſet, azure, ſinaper, and black, make a ſanguine or murry colour.

Red lead and maſticot make a lion tawny.

Now all theſe mixtures may bee lightned, and diverſly varied, according as they are mixed with more or leſſe, whence ariſe ſundry medlyes, which would be too tedious for me here to recite.

Of liquors to diaper withall.

Cut fine litmoſe in peeces, ſteep it twenty foure houres in gum water, and the water will be as blew as azure, with which you may diaper, and ſet out all other blewes, and gums for a need. Flory blew ground with roſſet, maketh a deep violet, adde to it a little ceruſe, and it will be a light violet; put a little more ceruſe, and a little allum, let it lie all night, and it will bee good to diaper on other greenes. Cinaper lake ground with the water of turnſoil, and ſtiffe gum water, will be a deep crimſon, and therewith you may diaper upon a light crimſon.

How to repreſent diamonds, and other precious ſtones.

Firſt lay the ground, gold or ſilver, as the colour of the ſtone requireth; when it is dry, burniſh it, and draw upon it ſquares, according as you will have the cuts or ſquares, then ſhadow it with tranſparant colors, according

unto the colours of the ſtones that you endevour to repreſent.

How to waſh your pencils.

Rub the ends of them well with ſoap, then lay them awhile in warm water to ſteep, then take them out, and waſh them well in cleane water.

Of paynting in oyle.

FIrſt I will ſhew you how to make ſize; then to prime your boards and cloathes; and alſo how to black your frames; then how to temper, order, and lay on your colours.

How to make ſize for your boards.

Take glew and ſeethe it very long in faire water, untill the glew be cleane diſſolved, and it is done.

How to make whiting.

Take the foreſaid ſize, mix it with whiting ground, heat it, and ſo white your boards, being made ſmooth, after you have whited them, let them dry; white them over a ſecond or third time, letting them dry after every whiting, then ſcrape them ſmooth, then draw it over with white lead tempered with oyle.

How to white or prime cloth.

Take the fineſt canvace that you can get, and ſmooth it over with a ſleekſtone, then ſize it over with ſize, and a little

little hony, and let it dry, then white it over once with whiting and ſize mixed with a little hony ; hony keeps it from cracking, peeling, and breaking out, then you may draw your picture on it, with a coale or ſuch like, and laſtly lay on your colours.

How to black your frames.

Temper lamp black with ſize, and therewith black your frames, you muſt only put your black unground into your ſize, ſtir it with your bruſh, and ſo work it.

How to gild the edges of your frames.

Take white lead, and a little red lead, grinde them together with linſeed oyle, and lay it over the place which you will gild, and let it dry a day or two, then lay it over againe with the ſame colour, and two dayes after you may cover it with leaſe gold ; firſt with a ſharp knife cut the gold in ſtrips, according unto your work, then with a feather lay it on, and preſſe it down with wooll, when it is dry, burniſh it.

Linſeed oyle is the beſt for pictures, but nut oyle is the beſt for ruffes, and all linnen ; for your linſeed oyle will turn yellow: divers Painters there are, who having haſte of work, do uſe to temper their colours with one part of fat oyle, and two of common linſeed oyle, and by this meanes they make the colours dry the ſooner : this fat oyle is only linſeed oyle expoſed to the weather, and ſo it becometh thicker, yet ſometimes you ſhall ſee it ſo thick, that you may cut it almoſt like butter. It may bee made by boyling the oyle awhile, but the former is the better ;

if

if your cloth have any knots on it, or uneven threds, then weare them off by rubbing it with a fine pummice ſtone.

Fleſh colour.

Take white lead, grinde it with oyle, lake, and vermilion, ſo you may make it pale or high coloured, at your pleaſure.

White.

Whiting is a white to white boards only, but white lead ground with nut oyle, maketh a perfect white.

Black, Lamp black, Printers black.

Lamp black is a good black; the black earth that the Printers that print maps and copper plates, is far better; but for velvets, Hartſhorn black, or Ivory black are the beſt, and it is thus made.

Hartſhorn or Ivory black, or velvet black.

Take Hartſhorn, or Ivory, burn it to coales, and then grinde it with oyle. It is made by burning Hartſhorn in a crucible cloſe ſtopt that the ayre come not in, for halfe an houre, afterwards ground and waſhed.

Charcoale black.

Charcoale black is good to ſhadow ruffes, or linnens, and it is thus made; grinde charcoales very ſmall with water, let it dry, and then grinde it with oyle.

Seacoale black:

Seacoale black ſerveth for divers uſes, as Hartſhorn black doth, and it is made as charcoale black is.

A falſe blew:

Blew of Inde is to make a falſe ground for a blew, and it muſt be ground with oyle.

Azure blew, Byce blew.

Azure blew or ſmalt muſt never be ground, nor your byce, but they muſt bee tempered with your knife upon the pallet.

Red, red lead, vermilion, lake.

Red lead is a good colour to lay under gold, vermilion is a crimſon colour, lake is the beſt blood colour.

A hayre colour.

Vmber is a hayre colour.

Yellow, maſticot, orpiment, gambaugium.

Maſticot is a perfect yellow, when you grinde it, you muſt rub it very lightly, elſe it will loſe the colour; alſo orpiment and gambaugium are both very good yellows.

Green Verdigreaſe.

Verdigreaſe is a good green, and it is uſually mixed among your blacks, to make them dry.

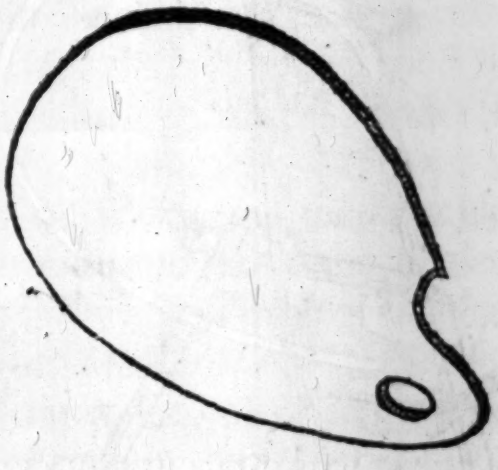
Yellow,

Yellow, yellow oker, reddiſh.

Yellow oker maketh a bright haire colour. Brown of *Spaine* maketh a kinde of reddiſh colour.

Red lead and verdigreaſe are drying colours, for being mixed with others that of themſelves will not dry, they make them for to dry.

Here followeth the figure of the Pallet to put your colours upon.



How to order your colour upon your Pallet.

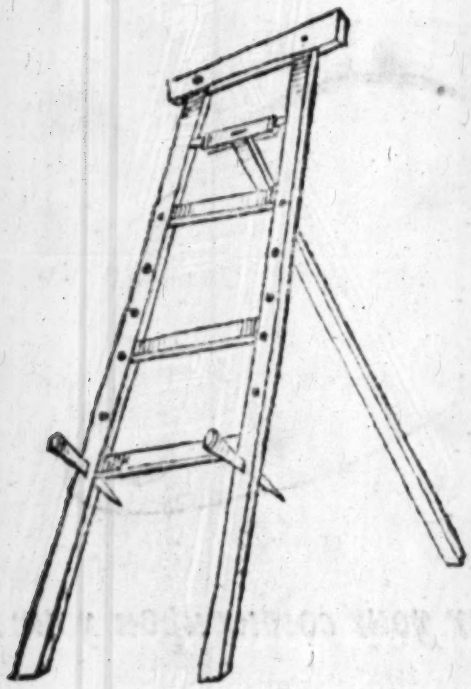
For the drawing of a picture, you muſt firſt lay your ſingle colours in order upon your Pallet thus; a little white lead, a little vermilion, a little lake, ſo tawny colour, or ſeacoale black, oker, verdigreaſe; then your bices for your blewes, yellowes, and other colours, at your pleaſure, each apart: when you have ſo diſpoſed them, make your mixtures under them.

You muſt have a frame made with a ſtay upon the

back, to ſet it higher or lower; and it muſt have divers holes in the two former railes of it, and there muſt bee two pins, on each ſide one: this frame is called by Artiſts an Eaſell, and it is to place your board or cloth nailed on a frame that you intend to work upon, for the more convenience of working it, and eaſe to the workman.

Now followeth the manner of mixing and laying your colours.

The Eaſell.



How to temper and lay your colours upon a picture.

Firſt you muſt begin with the white of the eye, and for it you muſt temper charcoale black with white lead, then lay a carnation or fleſh colour over the face, and for to make this, you muſt temper white lead with lake and vermilion; then ſhadow the face as you ſee cauſe, and

make

make the noſe at your pleaſure ; draw the compaſſe of the noſe with ſome dark reddiſh ſhadow, then ſhadow your cheeks and lips, with the ſtroak between the lips, with vermilion and lake : if need require it, you may lay it with white, or ſome light ſhadow, but the ſtroak between the lips muſt bee all lake, or moſt of it ; then make the circles of the eyes : for a grey eye, mix charcoale black with white lead, the brighter you will have it, put the more white lead ; the ſadder, the more black ; for the black circle of the eye, lake, umber, ſeacoale black, and a little white, mix them according to diſcretion ; to make the round black in the midſt of the eye, mix lamp black with verdigreaſe ; for the hands, you muſt firſt lay them with fleſh colour, as the face, and ſhadow the veines with the ſame ſhadowes, making the ſhadowes between the fingers, ſomewhat ſadder, and the knuckles ſomewhat redder with vermilion and lake : the nayles go over with a light ſtroak of white, and ſhadow them above with a dark fleſh colour ſhadow, ſomewhat ſad : if you would have your fleſh colour to look any thing yellow, you may put a little yellow oker to it, and make it as much or as little as you will : for a black or ſwarthy colour or complexion, you muſt make it as it followeth ; mix vermilion, white lead, lake, and yellow oker, the browner you will have it, put the more umber into the ſhadowes, make the ſhadow of umber and ſeacoale black.

For the hayre and teeth.

For black hayre take lamp black, and where you would have it brighter, mix it with umber, and white lead, and red lead : for flaxen hayre, take umber and white lead,

the browner, the more umber ; the brighter, the more white ; yet if you will have it a little browne, mingle a little ſeacoale black with it : for yellow hayre take maſticot, umber, yellow oker, and a little red lead ; the redder you will have it, put to the more red lead and umber: for white hayre take halfe Ivory black, and halfe umber, temper them with your knife, with white lead ; the whiter you would have them, put to the more white ; the darker, the more umber and Ivory.

For the teeth take white lead, and ſhadow it with charcoale black.

Colours for apparrell.

For Linnen.

For ruffes take charcoale black, and mix it with white lead, make it darker or lighter at your pleaſure ; but when you make your lace on ruffes, cuffes, or ſuch like, you muſt put to it a little oyle and ſmalt ; you muſt remember, as I have already told you, to temper all your colours for linnen with oyle of nuts, for linſeed oyle will turn yellow.

For Velvets.

For black velvet take lamp black and verdigreaſe, for your firſt ground ; when that is dry, take Ivory black, and verdigreaſe ; ſhadow it with a little white lead mixed with lamp black.

For green velvet take lamp black and white lead, and work it like a ruſſet velvet, and let it dry ; then draw it over with verdigreaſe tempered with a little pinck:

For

For ſeagreen velvet take only verdigreaſe, lay it over the foreſaid ruſſet: If you will have it a graſſe green, put a little maſticot unto it; you muſt ſhadow theſe greens in ruſſet; for the lighter or ſadder you would have your green to be, you muſt firſt lay your ruſſet accordingly.

For red velvet take vermilion, and ſhadow it with brown of Spain; where you will have it darkeſt, take ſea-coale black and brown of Spain to ſhadow among the foreſaid colours; let it dry, and then gloſſe it over with lake.

For crimſon or carnation velvet take the more or leſſe white lead to the vermilion at your pleaſure.

For blew velvet take oyle and ſmalt.

For yellow velvet take maſticot and yellow oker, and where you will have it darkeſt, ſhadow it with umber.

For tawny velvet take brown of Spain, white lead, and lamp black, mixt with a little verdigreaſe, to ſhadow where there is occaſion; when it is dry, gloſſe it over with lake and a little red lead.

For purple velvet take oyle, ſmalt, and lake, of each a like proportion, temper them together, with white lead, bright or ſad it according unto your diſcretion.

For aſh colour velvet take charcoale black and white lead, lighten it as you pleaſe with white lead; you muſt temper a colour like unto a dark ruſſet, and this will be an aſh colour.

For haire coloured velvet take umber ground of it ſelfe, and where your glaſſe ſhall bee brighteſt, mix ſome white lead, and where you make the folds about the edges, lighten or darken it with white lead and umber.

Note, that when you work velvet, you muſt at the firſt work it ſomewhat ſad, and then give it a ſudden brightneſſe.

Sattens.

Sattens.

For black ſatten take lamp black, and grinde it with oyle, and then temper it with white lead, and where you will have it to ſhine moſt, mix a little lake with the white lead.

For white ſatten take white lead, and grinde it by it ſelfe, alſo grinde Ivory black by it ſelfe; theſe you muſt temper lighter or darker according as you would have your ſatten ſhew.

For green ſatten take verdigreaſe, and grinde it by it ſelfe, then mix ſome white lead therewith, and where you would have it ſhew brighteſt, adde ſome pinck to it. If you would have it more popingey, adde more pinck to your white lead; where you would ſhadow it deepeſt, adde more verdigreaſe.

For yellow ſatten take maſticot, and grinde it by it ſelfe, yellow oker by it ſelfe, and umber by it ſelfe; where you would have it brighteſt, uſe maſticot alone, where you would have a light ſhadow, let oker ſerve, where darkeſt, take umber; you may mix them at pleaſure, but where you will have the ſaddeſt ſhadow, uſe umber only.

For blew ſatten take oyle, ſmalt, and white lead, mix them, where you would have it ſaddeſt, uſe ſmalt, where lighteſt, uſe white lead.

For a purple ſatten lay ſmalt alone, and where you would have it brighteſt, uſe white lead.

For orange tawny ſatten take red lead and lake, where you will have it brighteſt, uſe red lead, and where ſaddeſt, uſe more lake.

For red ſatten grinde brown of Spain by it ſelfe, mix it with

with vermilion, and where it ſhall be brighteſt, mix white lead with your vermilion.

For haire colour ſatten mix umber and white lead, where you will have it ſhew brighteſt, put more white lead, and where you will have the cuts moſt ſhadowed, uſe a little ſeacoale black with your umber.

For taffaties.

You muſt make your taffaties as you do your ſattens, laying the changeable taffaties thus : take divers colours, as you ſhall ſee beſt, and lay them one by another upon your work, and ſo ſhadow them with another, and work them finely one amongſt another, at your pleaſure.

For cloth.

It is in a manner all one to make cloth and ſatten, but you muſt not give your cloth ſo ſudden a ſhining gloſſe. To make cloth of gold, take brown oker and liquid gold, water and highten upon the ſame with ſmall gold ſtroaks.

For leather.

For Buffe take yellow oker and ſome white lead, work it, and where you would have it dark by degrees, mix it with a little umber, and when you have wrought it all over, take a broad pencill, and ſize it over with a little umber and ſeacoale black.

For yellow leather take maſticot, and yellow oker, and umber to ſhadow it more or leſſe at your pleaſure.

For black leather for ſhooes take lamp black, and ſhadow it with white lead more or leſſe.

For metals.

For iron take lamp black well tempered with white lead; if you will have it dun or rusty, take some seacoale black, and mix it with a little white.

For silver take charcoale black and white lead, and where you will have it darkest, use more charcoale, and work your silver somewhat rustish, then give it a sudden glosse with white lead only, where you think good.

For gold take lake, umber, red lead, and masticot; these are the colours for gold; you must lay the ground with red lead, and a little dry pinck, if you please; where you will have it darkest, shadow it most with umber, and where lightest, with masticot.

Note, that when you grinde your red lead to make your gold size, you must put a little verdigrease into it, to make it dry the sooner.

For Pearles.

For to make Pearles you must temper charcoale black with white lead, untill it become a perfect russet; then make your pearle with it, and give it a speck of white lead, only to make it shine: note, that the glissening ceruse which was mentioned in the Art of Limming, being tempered with oyle of white poppy, is most excellent to highten up pearles.

For precious stones.

To make Carbuncles, Rubies, &c. you must first lay their counterfeit grounds, then with transparant colours, (such

(ſuch as are lake, verdigreaſe, and verditer) give them a ſhining gloſſe.

For fire.

For fire, where it is reddeſt, lay red lead, and vermillon tempered together; where the flame is blew, take oyle, ſmalt, and white lead; where it is yellow, take maſticot, and work it over in ſome places, where you will have it ſhine moſt, with vermilion, yet ſo as your vermilion may appeare.

For the sky.

Take oyle, ſmalt, and mix them with linſeed oyle on your pallet; you muſt not grinde it all, (for then it will loſe its colour) temper it with white lead only, as bright as you will have it, and where it looketh red, uſe lake with your white lead, and ſmalt.

For wood.

For ſome kindes of wood you muſt take lake, umber, and white; for others, charcoale and white; for others, ſeacoale and white; for ſome alſo umber, black, white, and a little green: alſo if your wood look red, take a little lake or vermilion among your foreſaid colours, as you ſhall think beſt.

How to waſh your pencils.

Take a deep drinking glaſſe, and fill it halfe full with cleane linſeed oyle, then put your pencils that you have

wrought with oyle, into the ſame, and rub their bruſh ends againſt the ſides of the glaſſe, and the oyle wil looſen the colour from off them, which wil ſink to the bottom of the glaſſe; you may uſe theſe ſetled colours for to prime your cloth and boards.

How to preſerve your oyle colours, and keep them from drying.

Put each colour by it ſelfe in little pans or pots, and ſet them in the water that they may be couered ouer therwith, and they wil keep moiſt a great while, that you may work with them at your pleaſure, otherwiſe they will dry quickly, and being once dry, wil neuer bee tempered again to work with.

Paintings muſt bee placed in their proper places, with their ſhadowes from the light.

Of diſtempering or working in great with water colours.

This kinde of work is all one with painting in oyle, ſaving that the colours are tempered with gum water, or ſize: it is more ſpeedily performed, but the colours will not continue ſo freſh as in oyle.

To make colouring called Vernix: to verniſh gold, ſilver, or any other colour on vellem, paper, timber, ſtone, &c.

Take bengewin, and bray it well betwixt two papers, then put it into a violl, and poure on it aqua vitæ, that it

it may ſtand above the bengewin three or foure fingers, and let it ſteep ſo a day or two; then put to it for halfe a violl of aqua vitæ five or ſix chieves of ſaffron ſlenderly ſtamped; this done, ſtrain it, and with a Pencill verniſh therewith any thing gilded, which will become bright and ſhining, drying it ſelfe immediately, and will continue the brightneſſe many yeares; but if you will verniſh on ſilver, then take the white that is found in bengewing and dreſſe it with aquâ vitæ as afore, leaving out the ſaffron, and the ſaid verniſh made with theſe only, is very good to verniſh all things, as well painted as not painted; for it maketh Tables of Walnut tree and Hebene to gliſter if it be laid on them, and all other things, as iron, copper, or tyn gilded, or not; it maketh bright, preſerveth and aideth the colour, and dryeth incontinent without taking duſt.

How to paynt glaſſe.

THere are two manner of wayes of painting upon glaſſe: the one is for oyle colour, the other for ſuch colours as are afterwards to be annealed or burnt on. Firſt of the firſt.

How to lay oyle colours upon glaſſe.

Firſt you muſt grinde your colour with gum water once, and afterwards temper it with Spaniſh turpentine; lay it on, and let it dry by the fire, and it is done.

How to paint glasse with colours, and to anneale them.

There are six principall colours used in painting glasse, whereof divers others may be made by mixing some with other; the names are these, yellow, white, three blacks, foure blewes, three reds, and six greens; the making whereof followeth in order.

Yellow.

Take an old groat, or any other peece of the purest refined silver, then take a quantity of brimston, and melt it, and then put your silver unto the melted brimston, and with a payre of small plyers take it out againe, and light it in the fire, hold it in your plyers untill it leave burning, then beat it to powder in a brazen morter, afterwards grinde it on a marble with gum Arabick water, and a small quantity of yellow oker; work with this what you will upon glasse, and let it dry of it selfe.

Another fairer yellow.

Take a quantity of good silver, cut it into small peeces, take then twice so much antimony beaten to powder, put them together in a small crucible, and set it in a hot fire, for the space of halfe an houre, then take it out of the fire, and cast it into any brasse thing, and afterwards beat it into powder. Note, that you must weigh the silver before you burn it, and weigh six times as much yellow oker, and seven times the weight of old earth that hath been

been ſcraped off iron annealed work, grinde all very wel together with your burnt ſilver, put it in a pot, ſtir it wel, and ſo uſe it.

White.

This colour is the glaſſe it ſelfe, and it may ſerve very wel without any other colour; you may diaper upon it with other glaſſe, or chryſtall ground to powder.

Black.

Take Iet and the ſcales of iron, and with a wet feather take up the ſcales that fly from the iron after the Smith hath taken a heat; theſe ſcales you muſt grinde on a Painters ſtone with the Iet and gum water, to be uſed as the former colours.

Another black.

Take a quantity of iron ſcales, as many copper ſcales, ſtamp them ſmall, and make them red hot in a cleane fire-ſhovell, then take halfe as much Iet as one of them; firſt grinde them ſmall, temper them with gum water, uſe them as the aforeſaid.

Blew, Red, and Green.

Theſe three colours are to bee uſed after one manner; provide beads, the cleereſt that you can get, of the forenamed colours, beat them to powder in a brazen morter, each colour apart by it ſelfe, then buy ſome Amel at the Goldſmiths of the ſame colours, which muſt alſo be very

cleere

cleere and transparant, grinde each by it selfe, then take two parts of beads, and one part of Amel, grinde them together, as you did your silver.

Another faire red.

Take a quantity of Dragons blood, beat it to powder, and put it into a linnen cloth, and put thereto some rectified spirit of wine, cover it close a little while, and it will grow tender, then wring it out into a pot, so the cleere will come, and all the drosse will remaine in the cloth, so you may use it when you need.

A faire carnation.

Take an ounce of tyn glasse, three ounces of Iet, five ounces of red oker, gum a quarter of an ounce, grinde them together, and use them.

Another carnation.

Take a quantity of Iet, halfe as much litharge of silver or glasse tyn, halfe as much iron scales, as much gum, and as much red chalk as all the rest do weigh, then grinde them, and use them.

Another excellent green.

Take a quantity of verdigrease, grinde it well with turpentine, when you have so done, put it in a pot, and when you use it, warm it on the fire.

How

How to anneale or burn your glaſſe, to make the colours abide.

You muſt take bricks, and make a furnace foure ſquare, one foot and a halfe broad, and a foot and a halfe high; when you have ſo done, lay divers little barres croſſe the top of it, five or ſix, or as many as you ſhall think fitting, then raiſe the furnace a foot and a halfe high above the barres, and it is done; you muſt have a plate of iron to lay all over the barres.

How to place your glaſſe in the furnace.

Take ſlakt lime, and ſift it thorow a ſieve upon the plate, then lay a row of glaſſe upon that bed of lime, then ſift another bed of lime, and lay another bed of glaſſe upon it, this do untill your furnace be full, lay alſo with every bed of glaſſe a peece of glaſſe which you may wipe over with any colour; theſe are called watches, for when you think your glaſſe is ſufficiently enough burnt, then with a paire of ſplyers take out the firſt and loweſt watch, lay it on a board, and when it is cold, try if you can ſcrape off the colour, if it hold faſt on, then you may take out that row, but if the colour ſcrape off, then it may abide the fire longer.

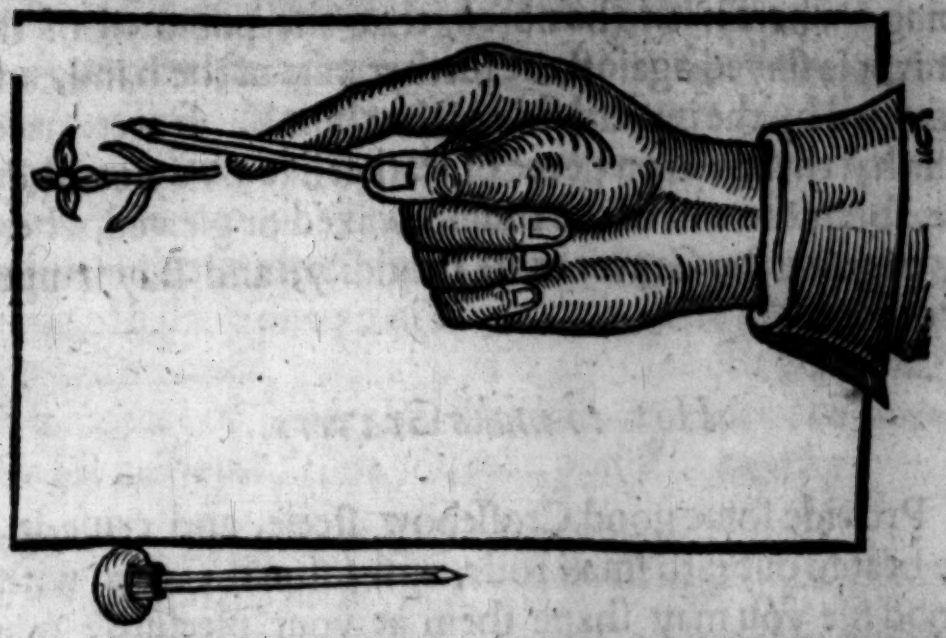
Of Graving.

IT is possible for one to be a good Painter, and yet not to be able to draw well with the pen, because there is not required in a Painter such a curious and exact carriage of the hand: but it is impossible for one ever to Grave or Etch well, except he can draw well with the pen. First therefore, presupposing you can do the first before you attempt the second, you must provide divers Graving tooles, both long and short: some for hard work, some for sweet work; some for smaller work, and some for greater: also a peece of a Beaver hat, and a good oyle stone, smoothed on one side, and free from pin holes, and plates of copper or brasse exactly polished.

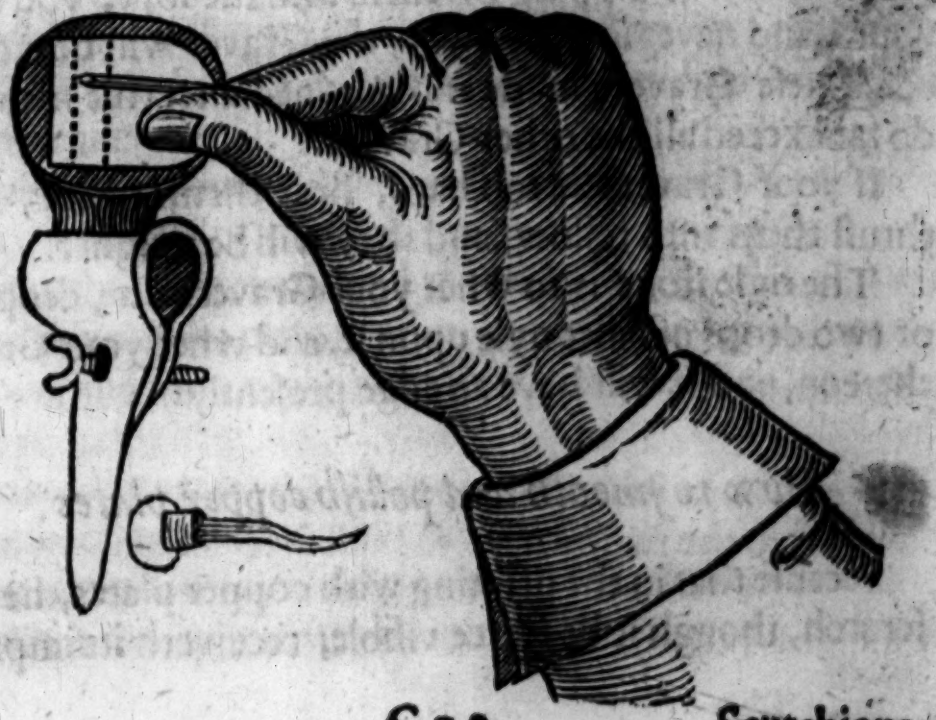
Of Gravers.

There are two principall sorts of Gravers, the long and the short: the long are straight, and for to engrave plates withall, especially the greater; and these are to bee held as the figure following doth expresse; where you may note that the pummell of the Graver resteth against the ball of the thumb, and the point is guided with the fore-finger. And there ought to be a little bagge of sand under your

your plate, to the end that you might turn your plate upon it as your work doth require.



The ſecond ſort is a ſhort Graver, and turneth up ſomewhat at the end, and that is to engrave Letters and



Scutchions in plate ſeales, and ſmaller plate, being faſtned in ſome convenient inſtrument: this muſt bee held likewiſe according unto the expreſſion of the figure foregoing: where it is to be noted, that the pummell of the Graver is ſtayed againſt the further part of the hand, and is guided by the inward ſide of the thumb. It were needfull that there were a peece of leather like a Taylors thimble, about the end of the thumb, waxed or glewed, whereby to guide the Graver more ſteaddily, and ſtay it upon occaſion.

How to make Gravers.

Provide ſome good Croſſebow ſteele, and cauſe it to be beaten out into ſmall rods, and ſoftned; then with a good file you may ſhape them at your pleaſure: when you have done, heat them red hot, and dip them ſtraight down into ſope, and by ſo doing, they will be hard indeed. Note, that if in dipping of them into the ſope, you turn your hand never ſo little awry, the Graver will be crooked. Theſe Gravers made and hardned after this manner, do far exceed all the other Gravers.

If your Gravers be too hard, heat them a little, and thruſt them into tallow, and they will be tougher.

The oyle ſtone is to whet your Gravers on; drop one or two drops of ſallet oyle upon it, and whet your Graver thereon, and it will have an edge preſently.

How to ſmooth and polliſh copper plates.

Becauſe that in the printing with copper plates, the leaſt ſcratch, though it be ſcarce viſible, receiveth its impreſſi-

on,

on, and ſo many times diſgraceth the work : I have ſet down a way to ſmooth plates for impreſſion.

Firſt, take a peece of braſſe or copper, of what bigneſſe you intend, of an indifferent thickneſſe, and ſee as neere as you can, that it be free from fire flawes : Firſt beat it as ſmooth as you can with a hammer, then rub it ſmooth with a pumice ſtone that is void of gravell, (leſt it race it, and ſo cauſe you as much more labour to get them out) burniſh it after with a burniſhing iron, having firſt dropped a drop or two of ſallet oyle on it ; then rub it over with a coale, prepared as is after taught ; and laſtly with a peece of Beaver hat dipt in ſallet oyle, rub it very well for an houre : thus you may polliſh it exactly.

How to prepare your Coales.

Take Beechen charcoale, ſuch as when they are broke, do ſhine, ſuch as are void of clifts, and ſuch as break off even : burn them againe, and as ſoone as they are all through on fire, quench them in chamber ly ; after take them out, and put them in faire water, and reſerve them for your uſe.

Having prepared all things in a readineſſe, you muſt have a draught of that you intend to cut or engrave.

Take the plate then, and wax it lightly over, and then either pounce the picture upon it, or trace it, or by drawing over the lines of the picture with ungummed inke, reprint it upon the plate ; then work upon it, obſerving the ſhadow, ſo that being printed, it may ſtand right, for it wil be backward upon your plate; when you have cut one ſtroke, drop a little ſallet oyle upon your peece of Beaver, and rub over the ſaid ſtroke, for by this meanes you ſhall

better ſee the ſtroke, and how to cut the next equall unto it, and ſo the reſt proportionally diſtant one from another; but to work by a candle, you muſt place a glaſſe of faire water between the candle, and a paper between that and the plate, (which caſteth a true light) or you will never be able to work truly and aright.

Of Etching.

ETching is an imitation of Engraving, but more ſpeedily performed. Things may bee expreſſed to the life thereby, but not ſo ſweetly as by the Graver. It is thus performed; the plate you are to etch upon, muſt firſt exactly be poliſhed, afterwards overlaid, but very lightly, with a ground made for the purpoſe, (of which anon) and thereupon muſt bee pounced, drawn, or traced, the thing that you are to etch; then the ſaid ground is to bee pierced with divers ſtiles of ſeverall bigneſſe, according as the ſhadowes of the picture do require; afterwards the edges of the plate are to bee raiſed with ſoft wax, and ſtrong water (for ſo they terme it:) (it is to bee had at the ſigne of the Legge in Foſter lane a Diſtillers) is to be put upon it, which in thoſe places where the ſtrokes are required to be lightly performed, is to be abated or alayed with faire water, which having dured awhile upon the plate, will eat into it, as it were engraven, then put it into cold water, and waſh it about, and it will leave eating further, and then take off the ground, and it is done.

A red ground for Etching.

Take red lead, grinde it very well, and temper it with verniſh.

A white ground.

Take one ounce of wax, and two ounces of roſin, melt them together, and adde thereto a quarter of an ounce of *Venice* ceruſe ground fine, lay it on while it is hot.

A black ground.

Take Aſphaltum two parts, Bees wax one part; melt them together, and being warme, lay it on very thinly with a fine lawn ragge. If it ſeeme ſomewhat red in any one part, hold it over the ſmoak of a link or wax candle, and it will be amended. Note, that it is a principall thing in this Art to lay the ground on aright.

Another way how to engrave with water.

Take verdigreaſe, Mercury ſublimated, vitreoll, and allum, a like quantity, beat all to powder, put them into a glaſſe, and let it ſtand ſo halfe a day, and ſtirre it often, then lay on the plate, wax mingled with linſeed oyle, or red lead with linſeed oyle, and write in it that you meane to grave, then put the water on it, and let it ſo remaine halfe a day, if you will have it very deep, let it lie longer. If you will engrave images, &c. lay the wax on the iron or ſteele, thin, and draw what you will thereon, that it may touch the metall, then put the water into the ſtrokes, and it will be engraven.

How

How to engrave on a flint ſtone.

Take a flint, and write on it what you will, with the fat or tallow of an Ox, afterward lay the flint in vineger, foure dayes.

The manner of engraving in wood.

The figures that are to be carved or graven in wood, muſt firſt be drawn, traced, or paſted upon the wood, and afterwards all the other ſtanding of the wood, except the figure, muſt be cut away with little narrow pointed knifes made for the purpoſe.

The working is farre more tedious and difficult than the working in braſſe: firſt, becauſe you muſt cut twice or thrice to take out one ſtroke, and when you have cut it ſo that it may be pickt out, yet if you have not a great care in picking it out, you may break out a part of your work, which may deface it: ſecondly, becauſe that in croſſe hatches you muſt ſtand picking, ſo that it would weary one to ſee ones work go ſo ſlowly on; yet a good reſolution may in time overcome theſe and other difficulties that attend thereupon; and for thoſe inconveniences an Artiſt may finde in the practiſe thereof, this is one commodity he ſhall gaine; he ſhall be private in his deſignes, for he himſelfe may print them when they are cut; nor ſhall they be expoſed to the view of every Stationer that frequent upon all occaſions the houſen of common workmen, whereby one receiveth much iniury and vexation.

Of

Of the choice of wood to cut in.

Box is the best; but Walnut tree, Beech, Maple, or any hard, close, and well seasoned wood may serve: let it be cut out and plained inch thick, and in peeces according as the bigneſſe of your figures do require.

Of drawing your figures upon the wood.

First grinde some white lead very fine, and temper it with faire water, and then dip a cloth in this misture, and rub over one side of your wood, and let it dry throughly; this keepeth the ink (if you draw on it therewith) that it run not about, nor sink; if you draw with pastils, it maketh your strokes appeare more plainly and brightly.

Of tracing your figures upon wood.

Having whited one side of your wood, as before, black or red the blanck side of your figure, as I have taught in the Art of Painting, and with a little stick or Swallowes quill trace or draw over the strokes of your figure.

Of pasting your figures upon wood.

Note, that you must not white over the wood when you intend to paste the figures, for that will make that your figure shall pill off, only see the wood be well plained, then wipe over the drawn or printed side of your figure with gum tragant dissolved in faire water, and clap it even and smooth upon your wood, and let it dry

throughly ; then wet it a little all over, and fret off the paper gently, untill you can see perfectly every stroke of your figure; then let it dry again, and when it is throughly dried, fall to cutting or carving it ; beware you fret not the figure away in any part when you are fretting it.

The manner of printing your wooden peeces.

In the following book of Extravagants I have taught how to make printing inke of sundry colours, to which I referre you ; you must have also some wooll bound up in a peece of sheeps leather, also a rowler smooth and even, which must have a peece of cotton bayes rowled hard twice about it ; first wet the paper you would print upon, with a sponge wet with allum water, then take some of the kindes of ink, and put it upon the leather, and lightly clap it all over the print, then put the paper that you wet, upon it, and rowle it hard on with the rowler, and it is done.

FINIS.

THE BOOKE OF EXTRAVAGANTS:

VVherein amongſt others, is principally contrived divers excellent and approved Medicines for ſeverall maladies.

By *I. B.*

LONDON,
Printed by *Thomas Harper*, for *Ralph Mab.* 1635.

To the Reader.

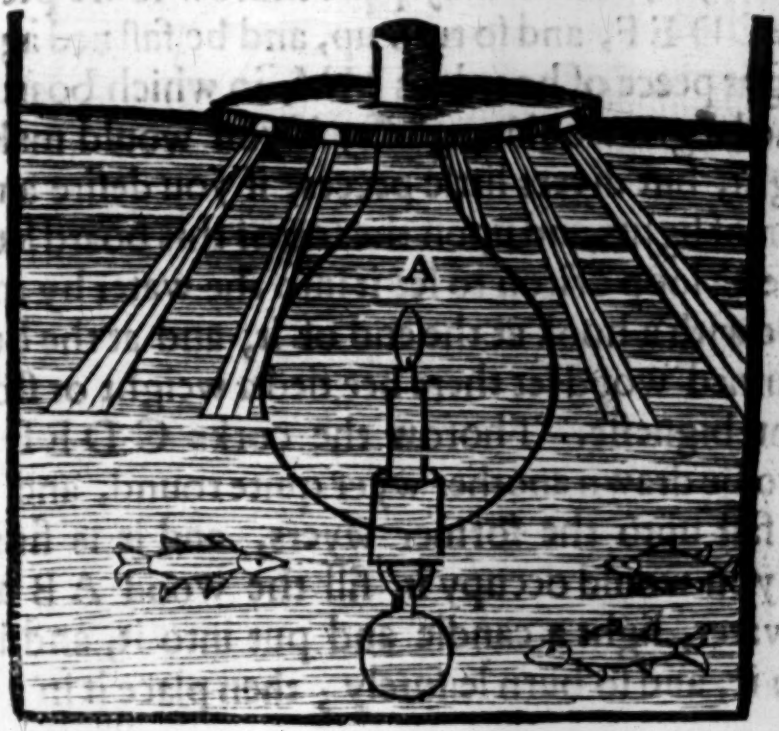
COurteous Reader, *forasmuch as there were divers experiments that I could not conveniently, or rather my occasions would not permit me to dispose in such order as I would have done; I thought it would not bee amisse to call them by the names of* Extravagants, *and so to set them downe as I found them, either inserted amongst other my notes, as I put them in practise, or as they came into remembrance. I would have beene more copious in Chirurgicall experiments, because I have always much delighted therein, and have both seen and made much experience thereof; but having considered with my selfe, that those things would best*

ſuit with themſelves, and bee acceptable unto every one, I have purpoſely made a reſervation of ſome, which accordingly as I ſhall perceive theſe to be affected, I ſhall, if God permit, preſent you with in a peculiar Tractat hereafter.

Extravagants.

How to make a light burne under the water, being a very pretty conceipt to take fiſh.

LEt there be a glaſſe, as A, having a hole at the bottom, to put a candle in with a ſcrewed ſocket. The ſocket muſt have a loop at the bottom, whereunto you muſt hang a weight of ſuch heavineſſe, that it may draw the body of the glaſſe under water. The neck of this glaſſe muſt be open, and ſtand



above

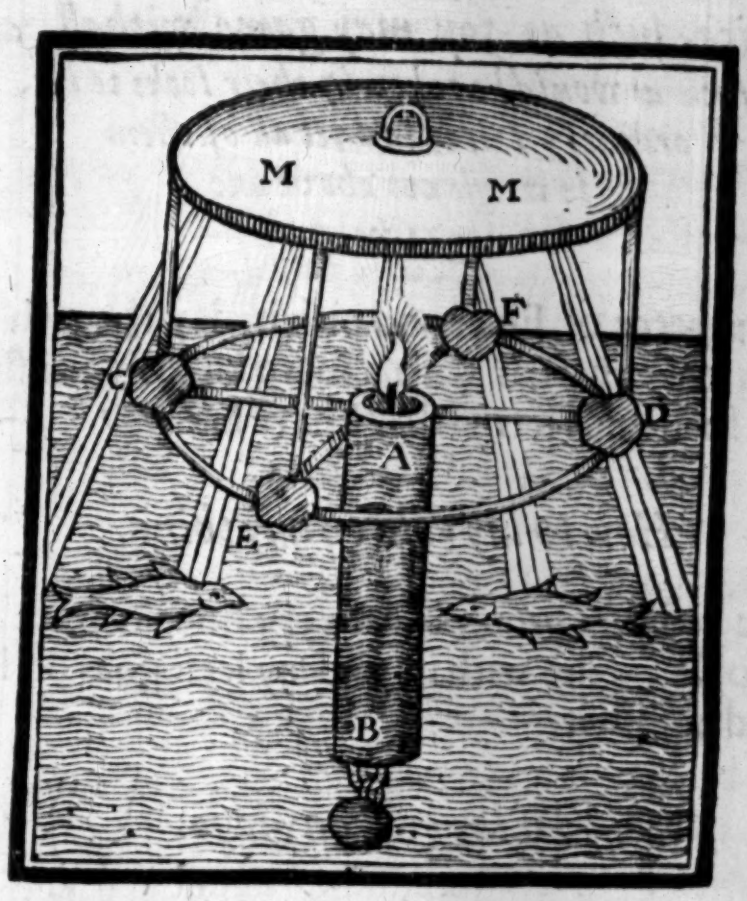
above the water; alſo about the neck muſt be faſtned a good broad peece of wood; round about which (but on that ſide of it that is next unto the water) muſt bee placed divers peeces of looking glaſſes; ſo the light of the candle in the glaſſe body will be multiplied according unto the number of them. All the fiſhes neere unto it will reſort about it, as amazed at ſo glorious a ſight, and ſo you may take them with a caſt net or other.

Another pretty conceipt for the ſame purpoſe, but more eaſie to be made, and with leſſe coſt.

Provide a peece of wood turned hollow like unto a poking or ſteele ſtick, as A B, in the top of this wood at the ſides of it let there faſtned foure little ſticks, or rather peeces of wyer, which may paſſe thorow foure peeces of cork, as C D E F, and ſo turn up, and be faſtned again in a thin light peece of board, as M M, in which board muſt be faſtned a great looking glaſſe, if you would make one great light, but divers little peeces, if you deſire a multiplication of lights, and upon the top of this board let there be faſtned a loop of iron to let it into the water by meanes of a pole with a hook at the end of it, and at the bottom of the turned wood let there bee tied a weight or ſtone of ſufficient bigneſſe. Thorow the corks C D E F there ought to be drawn another wyer quite round, and to be bound faſt unto the former wyers, and it is finiſhed. When you would occupy it, fill the wood A B almoſt full of water, light a candle and put into it, and it will ſwim in it, and ſo burn leiſurely; then place it in a pond

or

or river, with a hook, and the light will be diſperſed in a great compaſſe about the water.



How to make an image hang in the middle of a glaſſe.

Make the lower part of the image of hard wax, and the upper part of wood, and overlay it with oyle colours; then put it into a globe glaſſe filled with faire water, and which way ſoever you turn the glaſſe, the image will ſtill hang in the middle, and ſtand as it were upright; which, to my knowledge, hath been a thing cauſing no ſmall admiration among divers that have not underſtood the cauſe of it.

How to make five or six Dice of the ordinary bigneſſe of Dice, ſuch as you may game withall, and ſuch as would be taken by their looks to be ordinary Dice, and yet all of them to weigh not above one graine.

Take a peece of Elder and pith it, lay the pith to dry, and then make thereof with a ſharp knife five or ſix Dice, and you ſhall finde it true that I have ſaid.

How to lay gold on any thing.

Take red lead ground firſt very fine, temper it with linſeed oyle: write with it, and lay leafe gold on it, let it dry, and polliſh it.

To lay gold on glaſſe.

Grinde chalk and red lead, of each a like quantity, together, temper them with linſeed oyle, lay it on; when it is almoſt dry, lay your leafe gold on it, when it is quite dry polliſh it.

How to make iron or ſteele exceeding hard.

Quench your inſtrument ſeven times in the blood of a male hog, mixed with gooſe greaſe, and at each time dry it at the fire before you wet it, and it will become exceeding hard, and not britle: approved.

To make iron as ſoft as lead.

Take black flints, powder them very finely; then put the powder in an iron pan, and make it red hot, then caſt it on a marble ſtone, till it be almoſt cold, then make it red hot againe, and let it coole, and grinde it ſo long till it cleave to the ſtone, and grinde as it were clay; then put that in a glaſſe, and ſet it under the eaves of a houſe, where the Sunne commeth not nigh in the day, then the night after take out the water that you ſhall finde in the glaſſe above the powder, then take that powder and grinde it with the water, and put it in a ſtillatory, and let it ſtill out the halfe; afterward poure the water againe on the ſaid powder, and ſtill it againe with a ſoft fire; then take and ſeethe that water till the halfe be waſted, then take ſome iron blade of a knife that is new broke, and put it together, and hold it ſo a little while; then take of the water which was ſod to the halfe, and with a feather lay it firſt to the one ſide of the blade, and when the water is cold, lay it on the other ſide, and it will ſoder faſt with this water; and with this water you may make ſteele as ſoft as lead. It is likewiſe a ſoveraigne water to help the gout, being anoynted where the griefe is, for it giveth eaſe very ſpeedily.

To colour tyn, or copper, &c. of a golden colour.

Take linſeed oyle, ſet it on the fire, ſcum it cleane, then put therein of amber, and aloe hepaticum, a like quantity, then beat and ſtirre all well together with the oyle till it wax thick; then take it off, and cover it cloſe, and ſet it

in the earth three dayes : when you would uſe it, ſtrike your metall all over therewith, and ſo let it dry, and it will be of a golden colour.

To gild iron with a water.

Take running water 3 pound, rochallum 3 pound, and Roman vitreoll one ounce, of verdigreaſe one penny weight, ſaltgem three ounces, orpiment one ounce, boyle all theſe together, and when it begins to boyle, put in lees of tartar and bayſalt, of each halfe an ounce, make it ſeethe, and being ſod a pretty while, take it from the fire, and ſtrike the iron over therewith, then let it dry againſt the fire, and then burniſh it.

To ſoder on iron.

Set your joynt of iron as cloſe as you can, then lay them ſo in a glowing fire ; then take of Venice glaſſe in fine powder, and the iron being red hot, caſt the powder thereon, and it ſhall ſoder of it ſelfe. If you clap it in clay, it will be the ſurer way.

To gild on iron or ſteele.

Take one ounce of argall, three drammes of vermilion, and two drammes of bole armoniack, with as much aqua vitæ, then work and grinde them all together on a ſtone, with linſeed oyle ; having ſo done, put thereto lapis calaminaris as big as a hazell nut, and grinde therewith in the end three or foure drops of verniſh ; take it off the ſtone,

and

ſtraine it thorow a linnen cloth into a ſtone pot, (for it muſt be as thick as hony) then ſtrike over your iron therwith, and let it dry, and then lay your gold or ſilver on, as you would do upon the verniſh.

A verniſh like gold, for tyn, ſilver, or copper.

Take ſmall pots well leaded, then put therein ſix ounces of linſeed oyle, one ounce of maſtick, one ounce of aloes epaticum ; make them altogether in fine powder, and then put it into your ſaid pot, and cover it with ſuch another ; yet in the bottom of the uppermoſt pot make a ſmall hole, wherein put a ſmall ſtick with a broad end beneath, to ſtir the other pot withall, and when the pots are ſet juſt together, cloſe them all about with good clay, and cover them all over alſo, leaving the hole open above to ſtir the other pot with the ſtick ; ſet it over the fire, and ſtir it as often as it ſeetheth, and when you will gild, polliſh your metall over firſt, and then ſtrike this over the metall, and let it dry in the Sunne.

How to melt metall very quickly, yea in a ſhell upon the fire.

Firſt make a bed or laying of metall, and upon it make another bed with powder of brimſton, ſaltpeter, and ſawduſt, a like quantity of either, then put fire to the ſaid powder with a burning charcoale, and you ſhall ſee that the metall will diſſolve incontinent, and bee in a maſſe : approved.

How to colour polliſhed iron of a fine reddiſh, blewiſh, or blackiſh colour.

Take your iron after that you have polliſhed it, and heat it a little, and then rub it over with ſome Dragons blood purified, and it will be of a fine tranſparant colour: a blew colour may bee brought upon iron or ſteele burniſhed, by laying it upon quick charcoale, blowing them lightly untill you ſee the colour come upon your iron, then take it out preſently; or by heating your iron firſt, and then rubbing it over with a wollen cloth dipt in endego ground and tempered with ſallet oyle; this blew is proper for coſtlets, muskets, and ſuch like, the former for ſmaller work. If you would have a black colour on iron, firſt make it cleane, then heat it, and rub it over while it is hot with an old ſtocken a little wet in ſallet oyle.

To lay gold on iron or other metall.

Take liquid verniſh l. 1. turpentine, and oyle of linſeed, of each an ounce, mix them well together; with this ground you may gild on any metall, firſt ſtriking it upon the metall, and afterward lay on the gold or ſilver: when it is dry, polliſh it.

To make ice that will melt in fire, but not diſſolve in water.

Take ſtrong water made with ſaltpeter, allum, and oyle of tartar, of each one pound; infuſe them together, then put into them a little aqua ardens, and it will preſently

ly coagulate them, and turn them into ice.

A cement as hard as ſtone.

Take powder of loadſtone, and of flints, a like quantity of either, and with whites of egs and gum dragant make paſte, and in a few dayes it will grow as hard as a ſtone.

To make paper waved like unto marble.

Take divers oyled colours, put them ſeverally in drops upon water, and ſtir the water lightly, and then wet the paper (being of ſome thickneſſe) with it, and it will bee waved like marble; dry them in the Sunne.

To make copper or braſſe have the colour of ſilver.

Take ſal armoniack, allum, and ſalt, of each a like quantity, and with a little filings of ſilver, let all be mixt together, then put them into the fire, that they may bee hot, and when they ſhall ceaſe to ſmoke, then with the ſame powdered and moyſtned with ſpittle, rub your copper or braſſe.

How to make glew to hold things together as faſt as ſtone.

Take of the powder of tile ſheard two pound, unſlakt lyme foure pound, oyle of linſeed a ſufficient quantity to temper the whole mixture; this is marvellous ſtrong.

To make a thin gelw.

Take *gluten piſcis*, beat the ſame ſtrongly on an Anvill till

till it be thin; after lay it to ſoke in water, untill it become very ſoft and tender; then work it like paſte, to make ſmall rowles thereof, which draw out very thin, and when you will work with it, put ſome of it into an earthen pot, with a little water, over the embers, and ſcum the ſame very cleane, and let it ſeethe a little while, then work with the ſame, keeping it ſtill over the fire. With this glew you may faſten peeces of glaſſe together.

How to make mouth glew.

Take Iſinglaſſe, and ſteep it in water untill ſuch time as you may eaſily pull it to peeces, after you have pulled it to peeces, put it into a glaſſe or pot well leaded, and ſet it *in balneo*, that is, in a pot of water on the fire, there let it remaine untill all or the moſt part of it be diſſolved, then ſtrain it thorow a wide haire ſieve, while it is hot, upon another courſe and cloſe haire ſieve, and when it is cold, it will be like a thick gelly, then you muſt cut it into long handſome peeces, and put all theſe peeces ſo cut, on a ſtring, ſo that they touch not one another, and hang them in the Sunne untill they are thorow dry, and it is made. If you would have it of a dainty ſmell, and aromaticall taſte, put into it a little cinamon bruiſed, and a little marjerom, and roſemary flowers, while it is diſſolving, and if you pleaſe, a ſmall quantity of brown ſugarcandy, to give it a ſweetiſh ſmatch.

To make iron have the colour of braſſe.

Firſt polliſh it well, rub it after with *aqua fortis*, wherin the filings of braſſe are diſſolved: the like may be done with

with Roman vitreoll dissolved in vineger and faire water, of each a like quantity; but it will not continue long.

To make wood or bone red for ever.

Take the powder of Brazill, mingle it well with milk, but so, that it be very red, and put therein either wood or bone, letting it lie in eight dayes, and it will look red for ever.

How with one candle to make as great a light, as otherwise of two or three of the same bignesse.

Cause a round and double glasse to be made, of a large size, and in fashion like a globe, but with a great round hole in the top, and in the concave part of the uppermost glasse, place a candle in a loose socket, and at the same hole or pipe which must be made at the side thereof, fill the same with spirit of wine, or some other cleere distilled water that will not putrifie, and this one candle will give a great and wonderfull light, somewhat resembling the Sunne beames.

A cement for broken glasses.

Beat the whitest fish glew with a hammer, till it begin to wax cleere, then cut the same into very small peeces, suffering the same to dissolve on a gentle fire, in a leaded pan, with a few drops of aqua vitæ, then let some other that standeth by, hold both the peeces that are to be cemented, over a chafingdish of coales, till they be warm; and during their heat, lay on the dissolved glew with a fine pensill; then binde the glasse with wyer or thred, and let it rest till it be cold.

An admirable ſecret of repreſenting the very forme of plants, by their aſhes, philoſophically prepared, ſpoken of by Quercitanus *and* Angelus Salæ.

Take, ſayth he, the ſalt both the fixed and the volatill alſo. Take the very ſpirit, and the phlegm of any herb, but let them all be rightly prepared; diſſolve them, and coagulate them, upon which if you put the water ſtilled from May dew, or elſe the proper water of the herb you would have appeare, cloſe them all very well in a glaſſe for the purpoſe, and by the heat of embers, or the naturall heat of ones body, at the bottom of the glaſſe, the very forme and Idæa thereof will be repreſented; which will ſuddenly vaniſh away, the heat being withdrawn from the bottom of the glaſſe. As I will not argue the impoſſibility of this experiment, ſo I would be loth to employ mine endeavours, untill I were expert therein.

A device how to make plants to grow in a place which herbs cannot be tranſported to be planted, by reaſon of the diſtance of the place.

Take what herb you pleaſe, burn it, and take the aſhes and put them into a melting pot, and binde another pot upon it, and lute them well together, and burn them in the fire for the ſpace of two houres, then take out the aſhes and poure hot water upon them, and let them ſtand two or three houres; then drain that water from them, which will be of a ſaltiſh taſte, then put more warm water unto the ſame aſhes, and after that hath ſtood awhile, let that alſo draine away, then put both theſe waters together,

and

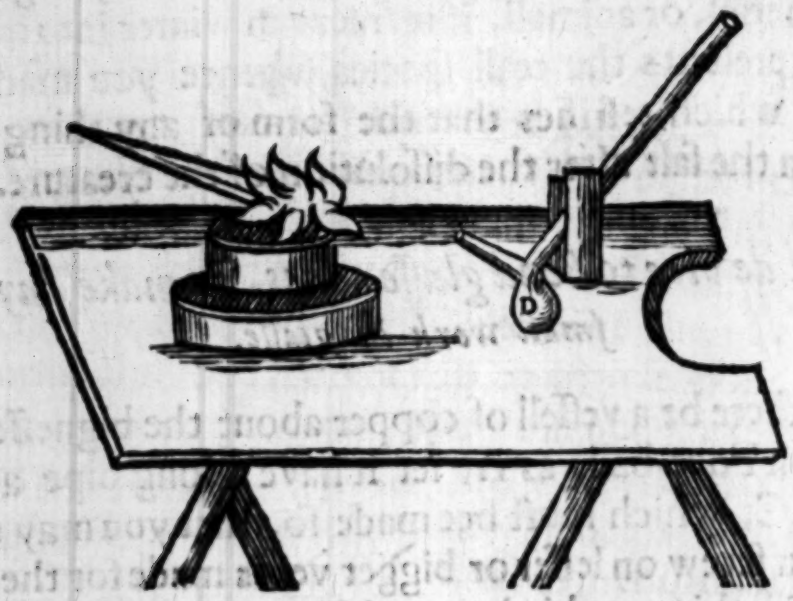
and boyle them gently on the fire, untill it bee consumed, and in the bottom of the vessell you shall have a kinde of salt, which take and sow in good ground wel prepared, and you shall have your desire. Note also, that the *lixivium* or ly made with water and the ashes of any vegetable, yea minerall, or animall, if it freeze in winter into ice, exactly represents the reall species whence you made the ashes; which testifies that the form of any thing continues in the salt after the dissolution of the creature.

A device to bend glasse canes, or make any small work in glasse.

Let there be a vessell of copper about the bigness of a common Foot-ball, as A, let it have a long pipe at the top, as C, which must bee made so, that you may upon occasion screw on lesser or bigger vents made for the purpose. Fill this one third part with water, and set it over a

furnace of coales, as F G I, and when the water begin-neth to heat, there will come a strong breath out of the nose of the vessel that wil force the flame of a lamp placed

at a convenient distance, as K ; if you hold your glasse in the extention of the flame, it wil melt suddenly ; so you may work what you wil thereof. There are that instead of this globe make use of a pipe, as D, fastned in a stick,



of which I have made use, but hold it not so convenient for those that are not accustomed thereunto.

An excellent water for any morphew, or scurvinesse in the face.

Take an ounce of quick sulphur, two ounces of black sope, the rankest and ill favourdst that can be got : binde them up in a cloth, and hang them in a pint of the strongest wine vineger for the space of nine dayes ; herewith wash the morphew in the face or elsewhere, and let it dry in of it selfe. This water wil for the present stain the face with a yelow colour, which wil weare away in time.

How

How to ſoften iron.

Take of alum, ſal armoniack, tartar, a like quantity of either, put them into good vineger, and ſet them on the fire; heat your iron, and quench it therein.

A good cement for broken glaſſes.

Take raw ſilk, and beat it with glaſſe, and mix them together with the whites of egs.

Another.

Take of calcined flints, quick lime, and common ſalt, of each a like quantity; mingle them al together with the whites of egs; then take a linnen cloth and ſpread it over with this mixture, and put it upon the fracture, and let it dry; afterwards anoynt it with Linſeed oyle.

How to cauſe that the ſame quantity both of powder and ſhot diſcharged out of the ſame Peece ſhall carry cloſer, or more ſcattering.

Take the quantity of a peaſe of opium, and charge it amongſt the ſhot, and this will make the ſhot to fly cloſer together than otherwiſe it would. This I had of a Seaman, who had made trial hereof, as hee ſaid, and unto whom I ſold ſome for the ſame purpoſe; and it is very probable, for it is of a congealing and fixative nature.

A bait to catch fiſh.

Take *Cocculus Indiæ* ℥ ſs, henbane ſeeds, and whea-

ten flower, of each a quarter of an ounce, hive hony as much as wil make them into paſte. Whete you ſee moſt ſtore of Fiſh in the River, caſt of this paſte into it in divers little bits about the bigneſſe of barley cornes, and anon you ſhal ſee the fiſh ſwimme on the top of the water, ſome reeling to and fro as drunken, others with their bellies upwards as if they were nigh dead; ſo that you may take them either with your hands, or a ſmall net at the end of a ſtick made for the ſame uſe. Note here, that if you put the fiſh that you thus take, into a bucket of faire and freſh water, or if it raine after that you have caſt this your bait into the water, they will revive and come to themſelves to your admiration; and this was told me by a Gentleman of good credit, that hath often made uſe thereof.

I have heard that the ſtinking oyle drawn out of the roots of polipody of the oak by a retort, mixed with turpentine, and hive hony, and being anoynted upon the bait will draw the fiſh mightily thereto, and make them bite the faſter: and I my ſelfe have ſeen fiſhes, as Roches, and taken in the dead time of winter with an angle, bayted only with paſte made of wheaten flowre, but it hath been in the morning, and when the Sunne hath ſhined.

How to write without inke that it may not be ſeen, unleſſe the paper be wet with water.

Take ſome vitreol, and powder it finely, and temper it with faire water in any thing that is clean, when it is diſſolved, you may write whatſoever you wil with it, and it cannot be read, except you draw it thorow water wherein ſome

ſome powder of gals hath been infuſed, and ſo it wil ſhew as black as if it had been written with inke.

How to make white letters in a black field.

Take the yolk of a new layd egg, and grinde it upon a marble with faire water, ſo as you may write with it: having ground it on this wiſe, then with a pen dipt into it, draw what letters you wil upon paper, or parchment, and when they are through dry, black al the the paper over with inke; and when it is dry, you may with a knife ſcrape al the letters of that you wrote with the yolk of the egg, and they wil ſhew faire and white.

How to ſoder upon ſilver, braſſe, or iron.

There are two kindes of Soder, to weet, hard Soder, and ſoft Soder. The ſoft Soder runneth ſooner than the hard; wherefore if a thing be to be ſodered in two places, which cannot at one time wel bee performed, then the firſt muſt be ſodered with hard ſoder, and the ſecond with ſoft; for if the firſt be done with ſoft, it wil unſoder again before the other be ſodered: Note, that if you would not have your ſoder to run over any one part of the peece to bee ſodered, you muſt rub over that part with chalk that you would not have it run upon.

Note likewiſe, that your ſoder muſt be beaten thin, and then layd over the place to be ſodered, which muſt be firſt fitted together, and bound with wyer as occaſion ſhal require. Then take Burras, powder it, and temper it with water like pap, and lay it upon the ſoder, and let it dry upon it by the fire: afterwards cover it with quick coales, and

blow

blow them up, and you ſhall ſee your ſoder run immediately; then preſently take it out of the fire, and it is done.

Hard Soder is thus made.

Take a quarter of an ounce of ſilver, and a three penny weight of copper, melt them together, and it is done.

Soft Soder is thus made.

Take a quarter of an ounce of ſilver, and a three penny weight of braſſe, melt them together, and it is done.

How to gild ſilver, or braſſe, with gold-water.

Firſt take about two ounces of quickſilver, put it into a little melting pot, and ſet it over the fire, and when it beginneth to ſmoke, put into it an angel of fine gold; then take it off preſently, for the gold wil preſently be diſſolved in the quickſilver, which if it be too thin, you may thorow a peece of fuſtian ſtrain a part of the quickſilver from it. Note likewiſe, that your ſilver or braſſe, before you go about to gild it, muſt bee boyled in argall, and beere, or water, and afterwards ſcratcht with a wyer bruſh; then rub the gold and the quickſilver upon it, and it wil cleave unto it, then put your ſilver or braſſe upon quick coales untill it begin to ſmoke; then take it from the fire, and ſcratch it with your wyer bruſh: do this ſo often till you have rubd the quickſilver as cleane off as you can, then ſhal you perceive the gold to appeare of a faint yelow colour, which you may make to appeare faire with ſal armoniack, bole armoniack, and verdigreaſe ground together, and tempered with water.

How

How to take the ſmoke of Tobacco thorow a glaſſe of water.

Firſt fil a pinte glaſſe with a wide mouth, almoſt ful of faire water; fil alſo a pipe of Tobacco, and put the pipe upright into the glaſſe of water, ſo that the end of the pipe may almoſt touch the bottom of the glaſſe; then take another crooked pipe, and put it into the glaſſe, but let the end thereof not touch the water; wax then the mouth of the glaſſe, that no ayre may come in nor out, but at the pipes: then put fire unto the Tobacco, and ſuck with your mouth at the end of the crooked pipe, and you ſhal ſee the ſmoke of the Tobacco penetrate the water, and break out of a bubble, and ſo come into your mouth.

How to colour wood of a fine brown colour.

Firſt take a bruſh made of hogs briſtles, and dip it into common *aqua fortis*, and therewith wet the wood al over, then dry it gently before the fire, and when the wood begins to change colour, rub it over with linſeed oyle, and then dry it in the Sunne, and it wil be of a dainty fine brown colour, as brown as a berry.

To colour Ivory or any other bones, of an excellent green colour.

Take *aqua fortis*, wherein diſſolvè as much copper as the ſaid water is able, then let the bones that you would have coloured, ly in the ſame al night, and they wil bee like a Smaragdin colour: *Mizaldus*.

How to make birds drunk, ſo that you may take them with your hands.

Take ſuch meat as they love, as wheat, barley, and lay the ſame to ſteep in the lees of wine, or elſe in the juyce of hemlock, and ſprinckle the ſame in places where birds uſe to haunt.

A way to catch Crowes.

Take the liver of a beaſt, and cut it in divers peeces, put then into each peece, ſome of the powder of *nux vomica*, and lay theſe peeces of liver in places where Crows and Ravens haunt. Anon after they have eaten them, you may take them with your hands, for they cannot fly away.

How to take Crows or Pigeons.

Take white peaſen, and ſteep them eight or nine dayes in the gall of an Ox; then caſt the ſame where they uſe to haunt.

You may make Partridges, Ducks, and other birds drunk, ſo that you may take them with your hand, if you ſet black wine for them to drink, in thoſe places whereunto they reſort.

Another.

Take tormentill, and boyle it in good wine; put into it barley or other graine: ſprinckle this in thoſe places you have appointed to take birds in, and the birds wil eat the peeces amongſt the graine, which wil make them ſo drunk,

drunk, that they cannot fly away. This ſhould bee done in the winter, and when it is a deep ſnow.

Another way to take birds.

Make a paſte of barley meale, onion blades, and henbane ſeeds; ſet the ſame upon ſeveral little boards, or peeces of tiles, or ſuch like, for the birds to eat of it.

How to make braſſe white for ever.

Take egge ſhels, and burn them in a melting pot: then powder them, and temper them with the whites of egges; let it ſtand ſo three weeks; heat your braſſe red hot, and put this upon it.

A devicee to ſcowre braſſe:

Take common *aqua fortis*, and faire water, of each a like quantity, ſhake them together, dip a woollen ragg in this water, and therewith rub your ruſty braſſe, and it will fetch off the ruſt immediatly; then preſently rub it off with an oyly cloth: laſtly with a dry wollen cloth dipt in the powder of *lapis calaminaris* (which you may have at the Apothecaries) rub it over hard, and it will be as cleere and bright as it was when it came new out of the ſhop.

How to make the apparitions of Towers and Caſtles to appeare in a glaſſe of water.

Take an Vrinall, and fill it almoſt full with faire water, and take a little ſaffron and tie it up in a fine linnen cloth,

and ſteep it in the ſaid water, and let it remaine untill it have turned the colour of the water, then take the white of an egg and break or ſqueeſe it between your fingers ſeven or eight times together, then put it into the water, and ſhake it together, and you ſhall ſee ſuch apparitions as I have ſaid. *Cardanus* and *Falopius*.

How to make the Philoſophers tree.

Take two ounces of *aqua fortis*, and put into it halfe an ounce of fine ſilver refined, then take an ounce of *aqua fortis*, and two drams of quickſilver, mix them together; mix both theſe miſtures or diſſolutions together: then put it into a glaſſe, with halfe a pinte of water, and ſtop it up cloſe with brimſton, and you ſhall day after day ſee the likeneſſe of a tree to grow by little and litt'e, very pleaſant to behold.

How to keep wine freſh all the yeere, though it be carried from place to place, and expoſed to the heat of the Sunne all day.

Put your wine in a glaſſe bottle, and put the bottle in a box of wood or leather, and about the glaſſe bottle put ſaltpeter, and it will preſerve and keep it very freſh. If you put ſome little quantity of ſaltpeter in the ſummer time when the weather is very hot, the ſaltpeter will make the wine ſo extreme cold, that it will even make the teeth of him chatter that holdeth it in his mouth.

How to make marble.

Take ſix ounces of quick lime, put it into a pot, and poure

poure upon it one pinte of good wine; let it ſtand five or ſix dayes, ſtirring it once or twice a day: then poure off the cleere, and therewith temper flint ſtones calcined, and made into fine powder, then colour it, and make of it what you pleaſe, and let them dry.

How to whiten copper.

Take a thin plate of copper, heat it red hot divers times, and extinguiſh it in common oyle of tartar, and it will be white.

To make Saltpeter.

Take quick lyme, and poure warm water upon it, and let it ſtand ſix dayes, ſtirring it once or twice a day: take the cleere of this, and ſet it in the Sunne untill it be waſted, and the Saltpeter will remain in the bottom.

How to make Corall.

Take of red lead gronnd, ℥ i, vermilion finely ground, ℥ ſs. unquenched lyme, and powder of calcined flints, of each ℥ vi. theſe powders muſt be tempered with a *lixivium* that is made with quick lime and wine: adde unto the whole a little ſalt; then make thereof what you liſt; then boyle them in linſeed oyle.

How to make pearles of chalk.

Take ſome chalk, and put it into the fire; there let it lie untill it break: temper it then with the whites of eggs. Then make of it divers faſhions of pearles, both great and

ſmall; wet them being dryed, and cover them with leaſe gold, and they are done.

A precious oyle for a ſudden ach cauſed through cold.

Take three pound of May butter unſalted, of Bay leaves three handfuls, of Chamomill, Featherfew, Wormwood, and Rew, of each two handfuls; ſhred all theſe finely into a pipkin cloſely ſtopped: let them boyle gently the ſpace of an houre, then put into them eighteen ſpoonfuls of ſallet oyle, and let them boyle an houre more; then adde two and twenty ſpoonfuls of *aqua vitæ*, and then let them infuſe a quarter of an houre more, then ſtrain it, and it is done: when you uſe it, warm it, and anoynt the grieved place therewith. Daily experience doth teſtifie the excellency of this medicine.

Againſt ſetting of cold about the head and ſtomack.

Take of the beſt Engliſh ſaffron, the weight of 1 s. 6 d. of liqueriſh halfe an ounce, angelica roots halfe an ounce, aniſeeds one ounce, elecampane roots a quarter of an ounce, one nutmeg ſliced, two branches of roſemary ſtripped: ſteep them all in a pinte and a halfe of the ſtrongeſt *aqua vitæ*, in a glaſſe ſtopped very cloſe, nine dayes together. Then let the ſick take two ſpoonfuls in the morning faſting, and as much at bed time.

An approved and excellent plaſter for the Sciatica, for ach in the raines of the back, or in any other part whatſoever.

Take one pound of black ſope, and foure ounces of frankincenſe,

frankincenſe, and a pinte of white wine vineger: boyle all together upon a gentle fire, untill it bee thicke; ſpread it then upon a leather, and apply it unto the grieved place. If the ach be very great and feruent, then adde unto it a little *aqua vitæ*, and it will be much better.

An excellent oyntment for the Shingles, Morphew, Tetters, and Ringwormes.

Take a quarter of a pound of ſope, and mingle with it two drams of the powder of blacke Ellebor, litharge of ſiluer in fine powder, two ounces, verdigreaſe halfe an ounce, and a quarter of an ounce of glaſſe in powder, and as much quickſilver, make them all into an oyntment by ſtirring them well together; wherewith anoynt the grieved parts. This is approued and true.

An excellent Balme, or water for grievous ſore eyes, which commeth either of outward accident, or of any inward cauſe.

Take two ſpoonefuls of the juyce of Fennell, and one ſpoontull and a halfe of the juyce of Celandine, and twice as much honey as them both; then boyle them a little upon a chafingdiſh of coales, and ſcum away the dregs which will aſcend, but firſt let it coole ſomewhat, and then let it run thorow a faire cleane cloth: then put it into a violl of glaſſe, and ſtop it cloſe. Put a little quantity of this into the eye. This medicine is approved, and more precious than gold.

A ſpeedy way to aſſwage the paine of any ſcald, or burne, though never ſo great, and to take the fire out of it.

Take old lawn rags, dip them into Runnet, for want of it dip them into verjuyce, and apply them cold upon the grieved place, ſhifting them for halfe an houre together, as oft as they dry: this I have knowne to give eaſe in an inſtant, and quickly to take out the fire.

An approved oyle for to heale any burne or ſcald.

Take of houſleeke one handfull, and of brooklime as much, boyle them in a quart of creame untill it turne unto an oyle; boyle it very gently: with this oyle a little warmed, anoint the grieved place twice a day, and it will ſoone make it well. Approved.

An oyntment, very excellent and often proved, for the ſame.

Take a good quantity of moſſe ſcraped from off a ſtone wall, fry it in a fryingpan with a call of mutton ſuet a good while, then ſtraine it, and it is done. Dreſſe the grieved part therewith once or twice a day, as you ſhall ſee fitting.

Another oyntment for a burne.

Take one part of fallet-oyle, and two parts of the whites of egges, beat them together exceeding well, untill they come to be a white oyntment, wherein dip the feather of a blacke hen, and anoynt the grieved place diuers times euery day, untill ſuch time as the ſcales fall off, uſing

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in the meane while neither clothes nor any outward binding, for these will stick, and so together draw off the skin. This, saith *Minshet* the author, though it seeme to be a thing of no estimation, yet was there neuer found any more effectuall for a burne than it is. Since I wrote this I received a Letter from an especiall friend in the Country that hath often times made use of it, affirming the excellency and undoubtednesse of it, saying also that this very medicine is of much value.

An excellent oyntment for a greene wound.

Take foure handfuls of Clownes, Allheale, bruise it, and put it into a pan, and put to it foure ounces of barrowes grease, sallet-oyle halfe a pound, Bees waxe a quarter of a pound; boyle them all untill the iuyce be wasted; then straine it, and set it ouer the fire againe, and put unto it two ounces of Turpentine, then boyle it a little while more, and it is done. Put hereof a little in a saucer, and set it on the fire, dip a tent in it, and lay it on the wound, but first lay another plaister round about the wound, made of diapalma mollified a little with oyle of Roses. This cureth very speedily all greene wounds, as saith M. *Gerard.*

A Balsam of wonderfull efficacy.

Take Burgundie pitch, brimstone, and white frankincense, of each one ounce: make them into an oyntment with the whites of egges: first draw the lips of the wound, or cut, as close as you can, then lay on some of this spread upon a cloth, and swathe it ouer afterwards.

An excellent healing Water, which will dry up any old sore, or heale any greene wound.

Take a quarter of a pound of Bolearmoniacke, powder it by it selfe, then take an ounce of Camphire, powder it also by it selfe: also take foure ounces of white Coppras in powder: mixe the Coppras and Camphire together, and put them into a melting pot, and set them on the fire, untill they turne unto water: afterwards stirre it until it come to be as hard as a stone: then powder it againe, and mixe it with the Bolearmoniacke: keepe this powder close in a bladder, when you would use it, take one pinte and a halfe of faire water, set it on the fire, and when it is even ready to boyle, put into it three spoonfuls of the powder, then take it off from the fire, and put it into a glasse, and let it stand untill it be cleare at the top, then take off the cleerest, and wash the sore very warme therewith, and dip a cloth foure double in the same water, and binde it fast about the sore with a rowler, and keepe it warme: dresse it thus twice a day.

A Water for a Fistula.

Take one pinte of white wine, 1 ounce of juyce of Sage, three penny weight of Borace in powder, Camphire in powder the weight of foure pence: boyle them all a pretty while on a gentle fire, and it is done: Wash the Fistula with this water, for it is certainly good, and approved to be true.

A Water for the Toothache.

Take ground ivie, sale, and spearemint, of each an handfull:

handfull: beat them very wel together, then boyle them in a pinte of vineger; ſtraine it, and put a ſpooneful of it into that ſide that aketh, and hold downe your cheeke.

Another Water approved for the ſame.

Take red roſe leaues halfe a handful, Pomegranate-flowers as many, two gaules ſliced thinne: boyle them all in three quarters of a pinte of red wine, and halfe a pinte of faire water untill the third part be waſted: then ſtraine it, and hold a little of it in your mouth a good while; then ſpit it out, and take more. Alſo if there be any ſwelling on your cheeke, apply the ſtrainings betweene two clothes as hot as may be ſuffered. This I haue knowne to doe good unto diuers in this Citie, when as they haue been extremely pained.

To make a Water for the eyes.

Take *Lapis Calaminaris*, and burne it in the fire nine times, and quench it in white wine, and beat it into powder, and when you uſe it, put it into roſe water, and drop the water into the eye.

For Deafeneſſe.

Take a good quantity of Camomill, and two handfuls of greene Wormewood, and ſeethe them in a pot of running water till they be very well ſodden, and put a funnell over it, and let the ſteame goe up into the eare, and then go to bed warme, and ſtop your eare with a little blacke wooll: and a graine of Civet: doe this morning and evening, and with Gods aſſiſtance you ſhall finde eaſe.

An excellent Electuary for the Cough, Cold, or againſt Flegme.

Take of Germander, Hiſſope, Horehound, white Maidenhaire, Agrimony, Bettony, Liverwort, Lungwort, and Harts-tongue, of each one handful: put theſe to nine pintes of water, and let them boyle to three pintes; then let it coole and ſtraine it. To this iuyce put of clarified honey halfe a pound, fine powder of Liquorice five ounces, fine powder of Enulacampana root three ounces, boyle them to the thickneſſe of an Electuary. Take of this at any time, but ſpecially in the morning faſting, as alſo at night when you goe to bed, or two houres after ſupper, the quantity of a Walnut or Nutmeg.

A very excellent ſalve to heale, well approved, for any old ſore; or new wound.

Take of Waxe, Roſin, Sheepes ſuet, Turpentine, of each a like quantity, Sallet oyle alſo as much: mixe them al together, and take the iuyce of Smallach, of Planten, of Orpin, of Bugloſſe, of Gomfery, of each a like quantity: let them boyle untill the juyce of the hearbes be conſumed; and in the ſeething put a quantity of Roſe-water, and it will be a very good Salve.

A ſoveraigne Water to heale a greene wound: and to ſtanch blood.

Take a pottle of running water, and put thereto foure ounces of Allum, and one ounce of Copras, and let them ſeethe

ſeethe to a quart, and then ſtraine it, and keep it in a glaſſe, and waſh the wound, and wet a cloth, and lay to the ſore, and with Gods helpe it wil ſoone be healed.

Againſt bleeding at the noſe.

Take the root of a red nettle, and hold it between the molary teeth of the ſame ſide: this is an excellent remedy: Alſo moſſe that groweth at the foot of an Aſh, is very good to be put up into the noſe. Likewiſe the powder of Toades. Alſo if you tye a live Toade in a net, and hang it about the patients necke, he wil be in a ſodaine feare, and ſo the bloud wil leave his former current, and have recourſe unto the heart. Or elſe a dryed Toad held in ones hand, or hanged about ones necke, though *inſcio patiente* from the natural apprehenſion of a venemous obiect, which whiles nature and the ſpirits ſeeking to avoyd, they run into the center of the body from the circumference.

For the biting of a mad Dogge.

Take brine, and bathe the wound: then burne Claret wine, and put in a little Mithridate, and ſo let the patient drinke it; Then take two live Pigeons, cut them thorow the middle, and lay them hot to his hand if hee be bitten in the armes. If in his legges, to the ſole of his feet.

An Oyle for any Ach.

Take a pound of unwaſhed butter, and a handful of red mints, and a handful of camomill, a handful of rew, two ounces of oyle of Exeter: ſtampe the hearbes to a juyce, and boyle them with the butter; ſtraine them in a cloth, and rub them out very wel: this ſo done, take the

oyle of Exeter, and put to them, and ſtir them wel together, and put them into a gally pot, and where the ach is anoint the place againſt the fire, and lay a browne paper on it, and wrap a cloth about the place, and keep it warm: proved to be excellent.

To ſtanch the bleeding of a cut.

Take a peece of a felt hat, and burne it to a coale; beat it to powder, and put it in the cut, and it wil ſtanch the bleeding preſently. Or elſe apply linnen rags that in the ſpring of the yeere have beene often waſhed in the ſperm of frogs, and afterward dryed in the Sunne.

For an ague, to be layd to the wriſts.

Take a handful of ſoot, a ſpooneful of bay ſalt, halfe a ſpooneful of pepper; bruiſe them together, and temper them with two yelkes of egges; ſpread it on a cloath, and lay it to the wriſts.

Almond milke for the cough of the lungs.

Take foure ſpoonfuls of French barley wel waſhed, and boyle it in three wine pints of faire water, unto a pinte and a halfe; then take it from the fire, and let it coole, and ſettle; then take the cleere liquor, and ſtraine therewith a quarter of a pound of ſweet almonds blanched, and beaten; then ſet it on the fire, and let it boyle a while til it begin to grow thicke; then beat two yelks of egges, and put them to it; ſtirre them wel together, and put to it as much fine ſuger as wil ſweeten it, and a ſpoonful of damaske roſe water, and ſo let it boyle a while longer, til it be as thicke

as

as good creame; eat of it warme twice or thrice a day, but at breakfaſt eſpecially.

For a ſcald head.

Take a pinte of running water, and as much Mercury as a good walnut, three or foure branches of Roſemary; boyle theſe al togeather til a third part bee boyled away, or thereabout, and every morning and evening waſh the infected place with ſome of this water cold, and a quarter of an houre after or leſſe anoint the place with lampe oyle, and every morning after the firſt dreſſing try to pul up ſome of the hayre as eaſily as you can: have care where you ſet this water, for it is poyſon. If you ſhave the head, and apply a plaiſter called *Emplaſtrum Cephalicum cum Euphorbio*, it is alſo excellent if you adde unto it in the making, a quantity of greene Copras:

For to heale a red face that hath many pimples. Proved.

Take foure ounces of barrowes greaſe, and as much oyle of bayes, halfe an ounce of quickſilver killed with faſting ſpettle, then take two ſpoonfuls of wilde tanſie water, or honyſuckle water, and let al bee ground in a morter three houres at the leaſt, until you ſee nothing of the quickſilver, and ſo keepe it cloſe in a glaſſe; the older, the better; and when you goe to bed anoint the face, and looke you keepe it from your eyes.

To waſh the Face if it be given to heat.

Take Snailes, beat them ſhels and bodies togeather: ſteep them

them a night in new milk; then ſtill them with the flowers of white Lillies.

To make odoriferous damask water.

Take new Ale with the graines in it, three gallons, chamomill three handfuls, balm, roſe leaves, of each foure handfuls; lavender and ſouthernwood, of each two handfuls; marjerom ſix handfuls; beat them all into groſſe powder, and then infuſe them in the Ale ten or twelve dayes, ſtirring it once or twice a day; then put it into a roſewater ſtill, and ſtrew upon it this following powder, and diſtill it with a gentle fire.

The Powder.

Take cloves, cipres roots, *calamus aromaticus*, of each one ounce; mace an ounce and a halfe, orris two ounces; ſtorax, benjamin, labdanum, of each halfe an ounce; make them into a powder.

A damask water that may be made at any time of the yeere.

Take lavender flowers two ounces, cloves ſix ounces; orris one pound, green Bay leaves two ounces, *calamus aromaticus* foure ounces, broom bark two ounces, ſtorax foure ounces, Cypres roots halfe a pound, margerom two handfuls; make them altogether into a groſſe powder, and infuſe it in five gallons of faire water three or foure dayes, in which time you muſt ſtirre it three or foure times a day, and cover it cloſe: then diſtill it with a gentl

fire

fire, while it is ſtilling, open it now and then, and ſtirre it, that it may not ſtick unto the bottom.

For a cold, or for chapt hands.

Bathe your feet oftentimes in beere wherein ſtore of ſalt and tartar hath been boyled, and dry it in by the fire; this is good for a cold.

Bathe your hands alſo in like manner, if they be chapt, for it is an excellent and moſt approved medicine.

Againſt the murrain of ſwine.

With an awle bore a hole in the top of one of their eares, and thruſt therein a little peece of the root of black elebor; it will cauſe their eares to ſwell, and ſtore of water will iſſue out thereat, and it will certainly free them from the murrain: approved.

A ſecret for Travellers.

It is a ſlight, but, in my opinion, an excellent thing, and a thing that I have much ſet by; let ſuch as uſe to travell, eſpecially in the ſummer time, have about them a peece of roch allum, which they may now and then hold for a ſmall time in their mouthes, for when they are hot it will both coole them and mightily refreſh them, and will quench their thirſt more than any beere can: I confeſſe, I have a better liking unto a ſtone that is made of ſaltpeter, and the eighth part of orientall and tranſparant ſulphur melted together, and caſt into bullet moulds; it is a ſtone that divers Mountebancks much eſteeme of, and it is called by them, A Celeſtiall or Miraculous Stone;

and by addition of certain colours, they make ſome red, ſome blew, and ſome of a ſtraw colour; and they attribute divers vertues unto it, as for curing the pin and web in the eye, for inflammations of the mouth and gums, and for curing of aking teeth: it is indeed nothing but the ſtone called of the Apothecaries *lapis prunella*, and which they ordinarily ſell. I have made uſe of allum when I could not come at this, and have found it for the aforeſaid uſe not much differing.

To make Vſquebach.

Take a gallon of the ſmalleſt *aqua vitæ* you can make, put it into a cloſe veſſell of ſtone; put thereto a quart of Canary Sack, two pound of raiſins of the Sunne ſtoned, but not waſhed, two ounces of Dates ſtoned, and the white skins of them pulled out, two ounces of cinamon groſly bruiſed, foure good nutmegs bruiſed, foure good liquoriſh ſticks ſliced, and bruiſed; tie up all your ſpices in a fine linnen cloth, and put them into your *aqua vitæ*, and tie up your pot very cloſe, and let this infuſe a week, ſtirring it three times a day, then let it run thorow a jelly bag cloſe covered; keep it in glaſſe bottles.

To make Almond butter.

Take two pound of Almonds and blanch them, and let them lie all night in cold water; then grinde them in a mortar very ſmall, and put in a blade of mace or two; then ſtraine it thorow a ſtrong cloth as neere as you can, that the milk bee not too thin, and let it ſeethe a pretty while, then put in a little roſewater, and a little ſalt, when you

you take it off the fire, and ſtir it ſtill ; then take a bigge cloth very cleane, and let two hold it, then you muſt take the milk and caſt it round about the ſides of the cloth, that the whay may come from it, then with a ſaucer put it down from the ſides ; then knit the cloth, and hang it up untill it have left dropping ; then take it forth, and ſeaſon it with fine ſugar and roſewater.

To make jelly for one that is in a Conſumption, or troubled with a looſeneſſe.

Take the feet of a calfe, and when the haire is cleane ſcalded off, ſlit them in the middle, and cut away all the black veines, and the fat, and waſh them very cleane, and ſo put them in a bucket of faire water, & let them lie foure and twenty houres, and in that time the oftner you ſhift them in faire water, it will be the better ; then ſet them on the fire in two gallons of water, or ſomewhat leſſe, and let them boyle very ſoftly, continually taking off the ſcum and fat which riſeth ; and when the liquor is more than halfe boyled away, put into it a pinte and a halfe of white wine, and as it boyleth there will come a foule ſcum upon it, take it off ſtill cleane, and when the jelly is boyled enough, you may know, for your fingers will ſtick to the ſpoon ; then take it from the fire, and with a cullender take out all the bones and fleſh, and when the jelly is almoſt cold, beat the whites of ſix egges, and put into it, and ſet it on the fire againe, and ſo let it boyle till it bee cleere ; then ſtraine it thorow a clean cloth into a baſon, and ſo let it ſtand all night long ; the next morning put it into a skellet, and put to it a pound of ſugar, halfe an ounce of cinamon broken in peeces, one ounce of nutmegs, an

ounce of ginger bruiſed, and a good quantity of large mace; boyle all theſe together till it taſte of the ſpices as much as you deſire, and when it is almoſt cold, take the whites of ſix egs, and beat them, and put into it, and ſet it on the fire, and when it riſeth weild it in halfe a pinte of white wine, then ſtrain it thorow a jelly bag.

To ſtay the flux.

Take Date ſtones, and beat them to fine powder, and take the quantity of one of them, and drink it with poſſet drink, or beere; uſe theſe two or three mornings together, and after as often as you finde occaſion; this is very good.

In the month of May gather of the reddeſt Oak leaves you can get, and ſtill them, and when need requireth make pap thereof, mingled with milk, fine flowre, ſugar, and cinamon, as oft as your ſtomack ſerveth to eat it.

How to make good writing Ink.

Take two handfuls of gauls, cut each gaul into three or foure peeces, poure into them a pinte of beere or wine, then let it ſtand eight houres; ſtraine it from the gauls, and put vitreoll therein, and to the vitreoll a third part of gum; ſet it on the fire to warm, but let it not ſeethe, and it will bee good Ink: and of theſe gauls you may make Ink foure or five times more.

How to make red printing Ink.

Take a ſpoonfull of vermilion, the quantity of a hazell nut of cleane turpentine, with a ſpoonfull and a halfe of linſeed

linſeed oyle; grinde them altogether upon a Painters ſtone, and it is done.

How to make blew printing Ink.

Take bice or ſmalt, and grinde them with turpentine and oyle, as you did the former.

How to make yellow printing Ink.

Take refined orpiment, and uſe it as you did the former.

How to make green printing Ink.

Take verdigreaſe or Spaniſh green very clean, and without ſtalks, and grinde it as you did the former.

How to make black printing Ink.

There is a black earth which thoſe that print Maps uſe of, this being ground as the former, with turpentine and linſeed oyle, you may make black Ink.

To make green Ink.

Take green bice and grinde it with gum water, and if you will have it a ſadder green, put a little ſaffron to the grinding.

To make blew Ink.

Take fine flowre, and grinde it with a little chalk, and allum, and then put it in a violl.

For an Ague.

Take a handfull of harſtongue that groweth in the field, and a handfull of bay ſalt, and beat them both together in a morter, and lay this to both the wriſts.

A good water againſt the plague, or to be given after a ſurfet.

Take red ſage, celendine, roſemary, herbgrace, wormwood, mugwort, pimpernell, dragons, ſcabious, egrimony, *roſa ſolis*, and balm, of each a handfull, or like quanty by weight; waſh and ſhake them in a cloth, then ſhred and put them into a gallon of white wine, with a quarter of an ounce of gentian roots, and as much of angelica roots; let it ſtand two dayes and two nights cloſe covered, and then diſtill it at your pleaſure, and ſtop the glaſſe very cloſe in which you keep the ſame.

To avoyd urine that is ſtopped with the ſtone.

Take as much black ſope as a walnut, temper it with eight or ten leaves of Engliſh ſaffron, ſpread it upon a round leather as big as the palm of your hand, and cover thenavell of you belly therewithall, and it ſhall cauſe you to make water. And I have been informed by a kinde of Leach that liveth in the Country, that he by applying a plaſter of galbanum ſpread upon a peece of leather round about the *preputium*, cured one that could not avoyd his urin by reaſon of a ſtone, which within a few houres the plaſter brought away, ſo that the party recovered, and became

became perfectly well ; who dying two or three yeeres after, rewarded this his Surgeon with a liberall reward.

For the ſtone and ſtrangury.

Take the filmes that are within the mawes of geeſe, and let them bee purely dryed, and then make powder thereof, and drink it with ſtale ale, and it will help him with Gods grace. Proved.

A good medicine to avoyd the ſtone and gravell.

In the morning faſting let the party ſwallow three or foure peeces of freſh butter about the bigneſſe of nutmegs, and drink immediatly after a glaſſe ful of white wine, and ſo faſt until dinner. It is a meane medicin, but not to be contemned, for there are thoſe that I know can affirm the goodneſſe and effects thereof.

For ſcald heads.

Take green copperas, and mingle it with creame til it bee turned yelow, and let it ſtand three or foure dayes: then take primroſe roots, leaves and all, with May butter, and beat the roots and leaves in the butter, and boyle them together with a little beere and butter, and let it touch no ſalt.

To cure an old ulcer.

Take a quart of the ſtrongeſt Ale that is to bee gotten, or brewed, halfe a pinte of raw honey, two ounces of roch-allum beaten, halfe a pinte of ſallet oyle, and the quantity

quantity of a Tennis ball of common washing sope, one ounce of stone pitch beaten, one ounce of rosin beaten, two ounces of yellow wax: boyle al these together, and strain them thorow a thin linnen cloth; and this wil cure any old ulcer.

A water to cleanse and mundifie old rotten sores and ulcers.

Take a wine pinte of stilled water of planten, as much white wine; put therein two ounces of roch allum, a dram of verdigrease, a dram of Mercury sublimed: boyle al these together, and keep them in a thick glasse being stopped with wax very close, that the strength go not out; this wil cleanse and mundifie old sores: It wil also heale a Fistula if you use a siringe, so that the water may be sent to the bottom of the sore.

The Medicine of Medicines proved for the stone:

Take a quantity of eg-shels, wash them cleane; those are the best whereout chickens are come; dry them very dry in an oven, or between two tile stones; then make powder thereof, searce it, and mingle it with sugar, or powder of licoras to give it a taste, and let him use it as often as hee needeth, morning and evening, either with Rhenish wine, white wine, or stale Ale, a spoonful of the powder at a time, and use to make water in a cleane bason, and so you shal see the deliverance thereof.

For dimneſſe of ſight.

Take the hearb called Eye bright, make it into fine powder, and take it either with meate or drinke, for it hath beene approved to be moſt excellent for all impediments of the ſight.

How to make Eye-bright Wine, Ale, or Beere: By the uſe whereof, divers that could not reade without ſpectacles, have miraculouſly recovered their ſights.

You muſt take two or three handfuls of the herbe Eye-bright, and put it in a bag that is made of fine boulter, put alſo unto it a dram and a halfe of ſweet Fenil ſeeds, and if you pleaſe, a Clove or two, or a blade of whole Mace, and into the bag put alſo a ſtone to make it ſinke, then hang it in a gallon of new wine or wort; if it bee wine ſtop it up cloſe preſently, if wort, ſtop it not untill it hath wrought. After it hath ſtood a weeke, you may drinke every morning a draught.

A precious water for the ſight.

Take Smallage, Fennell, Rew, Verveine, Egrimony, Daffadill, Pimpernell, and Sage, and ſtill them with breaſt milke together with five drams of frankincenſe, and drop of it in your eyes each night: often proved.

For the Fluxe to ſtay it.

Take the yolke of an Egge, and beat it, then mixe with

it one grated Nutmegge, and lay it on an hot tyle ſtone to bake, and eate thereof faſting, and before Supper, and after meales, and it wil ſtay it. Often proved to be excellent

A good Powder for the Gout.

Take fine Ginger the weight of two groats, and Enulacampane roots dryed, the weight of foure groats, of Liquoriſh the weight of eight groats, of Sugar-candy three ounces; beat all theſe into a powder, ſearce them fine, and then mingle them together, and drinke thereof morning and evening, and al times of the day. Approved.

A ſpeciall Medicine for the Collicke.

Take Horehound halfe an handfull, of Sage, and Hyſope of either as much, twelve leaves of Betony, of Centaury ſixe crops, one Alexander-root, foure penny weight of Enula-campana roots powdered, Spikenard of Spaine one penny worth; ſeethe all theſe in three quarts of fine wort to a pottle, and draw it through a linnen cloth, and take three ſpoonfuls at once morning and evening.

To take away redneſſe or burning of the Eyes.

Take the white of an Egge, and beat it very well with a ſpoonfull or two of red Roſe-water, then put thereto the pap of a roſted apple, mingle them well together, and ſpread it upon a little Flaxe; ſo lay it on the eye, binding it on with a linnen cloth:

A Water for the falling downe of rheume in the eyes.

Take the quantity of a large hazell nut of white Co-

pras,

pras, and dissolue it in three quarters of a pinte of running water; with this water a little warmed bath the eye-lid divers times in a day. Approved.

For the Rheume in the eyes.

Take the white of an Egge, and so much Bolearmoniacke as will thicken it, and spread it on a round plaister of sheeps leather, and lay it on the temples on that side the Rheum is.

The Oyntment for the same.

Take *Lapis tutie* and burne it in a fire-shovell of quicke coales, quench it in a poringer of womans milke, doe so halfe a score times, then grinde it in a cleane morter till it bee very fine powder, then mingle it with fresh Barrowes grease till it looke russet: anoint your eyes with a little of it when you goe to bed.

For Deafenesse.

Take Rew, and rub it betweene the palmes of your hands untill it be so brused, that you may make thereof a tent; then dip it in sweet sallet oyle, and put in each eare one, so that you may pull them forth againe. This doe for seven or eight daies, and change the tent every day.

Take a quarter of a pinte of Angelica water, of *Cardus Benedictus* water, and of white wine, of either a like quantity: mingle them together, dividing the same into

two equall parts; drinke it in two ſeverall mornings: then the next night after the taking of the ſecond draught of water, take the fiſh of an oyſter, and put it into a fayre linnen cloth, and ſtop the ſame into the eare that is thickeſt of hearing, and lye on that ſide as long as you can: in the morning pick that eare as cleane as you can, and after that take a draught of the beſt ale you can get, with a toaſt of houſhold bread toaſted very dry, a reaſonable quantity of nutmegs; uſe the ſame every morning for five or ſixe dayes, faſting after the taking hereof two houres, every time you take it.

For the cough of the lungs.

Take two handfuls of Roſemary, & ſtrip it off the ſtalke, one of Hiſſop, and ſeethe them in a pottle of running water, till it come to a quart, and then put a quarter of a pound of fine ſugar, and let it ſeethe a little, and ſcum it, drinke it morning and evening.

A preſent remedy for all manner aches, and bruiſes in the Bones.

Take a good quantity of Wallwort, and a certaine quantity of Balme, and Smallach, and ſtampe them, and take a pound of May Butter, and temper them very well together, then make them into round bals, and let them lye for the ſpace of eight daies after, and then ſtamp them againe as you did before: then take it, & fry it, & ſtraine it, and put it into an earthen pot: This will helpe the bruiſe, be it never ſo blacke.

For burning or ſcalding.

To take out the fire, beat onyons very ſmall, and binde them to the place. To heale it, take halfe a pound of ſheeps ſuet, as much ſheeps dung, a quarter of a pound of the inner rinde of an elder tree, and a little Houſleeke: fry them together, and ſtrain it, and uſe it as a plaiſter, or make a ſerecloth of it, and apply it to the grieved part.

For Burſtneſſe of old, or young.

Take nine red Snailes, lay them betweene two tyles of clay, ſo that they creep not nor ſlide away, and bake them in the hot embers, or in an oven, till they may be powdered, then take the powder of one of the Snailes, and put it in white wine, and let the patient drinke it in the morning at his riſing, and faſt two houres after, and drinke theſe nine Snailes in eighteene daies, that is, every other day one. And if the ſickneſſe be ſo old that it will not heale in eighteen daies, begin again, and drinke other nine Snailes, and he ſhall be whole: this conſidered that he weare a Truſſe in the mean time, according to the manner of the rupture.

A Salve for all ſores.

Take a pound of ſheeps tallow, and a pound of Turpentine, and a pound of Virgin-waxe, a pinte of Sallet oyle, a quarter of a pound of Roſin: take alſo Bugle, Smallach, and Plantaine halfe the quantity of the other, or ſo much as will make a pinte juſt: boyle all theſe together upon a ſoft fire of coales, alwaies ſtirring it till a third part be conſumed; then take it from the fire, and ſtraine it thorow a new canvas cloth into an earthen pot.

For Bleeding.

Take a blacke Toade in May, dry it betweene two tile ſtones, and hang it in Sarcenet about the parties necke.

To procure ſleepe.

Take Betony, Roſe leaves, Vinegar, Nutmeg, and the crummes of Rye-bread: put this in a cloth warme to the poll of the head.

For the Cough.

Two handfuls of laſt Savery, ſteep it five daies in white wine vineger, put into the vineger halfe an ounce of Pepper, at the five daies end draine out the vineger, and as ſoone as the bread is drawne, ſet them in a Pewter diſh into the oven, and ſtop it up, and let them ſtand all night. In the morning take them out of the Oven and powder them: Take of this powder and drinke it with Sacke, ſo much of it as will lye on a three-pence.

A Gargill for the Vvula.

Take a pinte of good ſtrong Ale, and as much Sacke, and a good quantity of long Pepper, & bruiſe it groſſely, and boyle it from a quart to a pinte, and let the parties gargle their mouthes, and throats as warme as they may ſuffer it.

If the pallat of the mouth be downe, it will fetch it up.

For deafneſſe very excellent good.

Take the hooſes of the Neats feet after they bee ſodden, and hold them in a cloth ſo warm as may be to your eare,

eare, divers times together one after another ; they will laſt to be warmed in the ſame they were ſodden in, ſome three or foure dayes without ſowring.

How to deſtroy vermin or lice in ones head or clothes.

There is a berry which you may buy at the Apothecaries, it is called *Cocculus Indiæ*; make it into fine powder, and ſtrew it in the hayre of the head, if the lice be only there, and binde the head cloſe up, and it will for certain ſlay them all before the next morning : if they be about the clothes and the body alſo, then mix ſome of the powder with ſome freſh butter or hogs greaſe, and anoynt the ſeames of the parties garments, eſpecially about the neck, waſte, and gatherings of the garments, alſo boyle ſome of the berries in a pinte of faire water, and the weight of 6 d. of Mercury ſublimate, then ſtrain it, and bathe the party with a cloth dipt in this water, made blood warm, but eſpecially about his joynts, and it will quit him, though he be never ſo full : approved.

How to make excellent troſſes or cakes to purifie the ayre in time of the plague.

Take one ounce of myrrhe powdered, alſo an ounce of the flowre of brimſton, as much balſam of *Pern* as will make them into a ſtiffe paſte, then make it into little cakes; you may in time of peſtilence every or every other day put one or two of theſe upon a chafingdiſh of quick coales, and betake your ſelfe into ſome other place, untill the ſmoke ceaſe. *Minſhet.*

To

To provoke ſweat, and to clenſe and clarifie the blood.

Give the party twenty graines of the flower of brimſton mingled with a little white wine vineger, or oximell ſimple; it will provoke to ſweat, and clenſe the blood mightily. *Idem.*

Brimſton mingled with pitch and ſo wrought upon wood, will not ſuffer it to be taken with wormes, nor to putrifie with winde or weather. *Idem.*

The ſmoke of brimſton conveyed with a convenient inſtrument into a veſſell of corrupt ſalt, and ſtinking water, it will in a ſhort time purifie the ſame, by ſending the dregs unto the bottom. *Idem.*

For an old ſore approved.

Take a pound of oyle of Olives, two ounces of hony, one ounce of turpentine, two ounces of white wax, frankincenſe, and olibanum, halfe an ounce of each, black pitch halfe a pound; melt them all together, and reſerve it for your uſe.

How to make white jelly.

Take two pound of Almonds, and make creame of them, then boyle three ounces of Iſinglaſſe in a quart of faire water, to a pinte, then mix it with your creame, adding to them one pound and a quarter of refined ſugar, and a quarter of a pinte of roſewater; boyle them all together a little while, and then ſtrain it, and it is done.

FINIS.

Here followeth a Table of every particular conteined in each Booke in order *as they lye.*

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